March, 1952

RECORDS of RESEARCHES

in the

FACULTY of AGRICULTURE
UNIVERSITY of TOKYO

No. I (1950 - 1951)

Published by

The FACULTY of AGRICULTURE, UNIVERSITY of TOKYO

Records of Researches
in the
Faculty of Agriculture University of Tokyo

No. I (1950 – 1951)

(東京大學農學部研究年報 第1號)

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PRINTED BY KASAI PUBLISHING & PRINTING CO.
MINATO-KU TOKYO JAPAN

PREFACE

The reports on research studies in the Faculty had been hitherto published as the Journal of the College of Agriculture which number reached to the 15th volume. However, since the war broke out, it became very difficult to continue its publication under the various circumstances and obliged to suspend it in consequence for a time being; but the situation of late has been improved so as to enabling to publish the results of studies again.

In consideration of the present state, we thought, instead of following the form of the past that is to print the complete text of reports on certain studies, it would be more appropriable to publish the outline of researches on all scientific subjects in broad scope carried out in the Faculty. So we have decided to realize our new attempt and here is its first number of "Records of Researches in the Faculty of Agriculture" issued.

In this connection, I wish to offer my heartfelt thanks to the Committee of Faculty Library, particularly to its Chairman Professor Yakichi NOGUCHI, who rendered his utmost effort and kind cooperation to this new undertaking and completion of the present publication.

Masao YOSHIDA
Director of the Faculty

Tokyo, March, 1952

I. Agriculture

Abstract Nos. 1 — 23

1. On the relation between virus disease and content of auxin in potatoes. Shinichiro KAWATA (Studies on the Plant Virus Diseases. pp. 52-64, 1950.)

The following four facts have been already found by the author: (1) the auxin-content of both the seed-potatoes and potato plants infected with virus disease is lower than that of the normal ones, (2) the infected plants appear with higher degree in the plants produced from the degenerated seed-potatoes, (3) even when the petioles of the infected leaves are treated with some synthetic auxin-pastes or solutions, the phenomenon of nacty is not so distinct as the normal ones and (4) auxin, in vitro, is inactivated with the juice of the infected plants.

Such an experiment was done in this study that the seed-potatoes infected with virus disease were treated with some synthetic auxins or they were cultivated under the favorable conditions to raise the auxin-content in them, but the negative result was obtained, so that it may be said with certainty that the virus diseases is not recovered from the infection with any method of raising up the auxin-content.

2. Rejuvenation of the degenerated seed-potato by the treatment with α-Naphtaleneacetic Acid. Shinichiro KAWATA (Journ. Hort. Ass. Japan **19** (3-4), 209-220, 1950.)

The degeneration of seed-potatoes is accompanied with decrease of auxin-content. The degenerated seed-potatoes without virus disease were treated with α-naphtaleneacetic acid in various degrees of concentration. The budding was effected at first; the higher the concentration is, the fewer the number of buds germinated and the effectiveness of α -naphtaleneacetic acid in the same concentration was controlled by the degree of the degeneration. The growth type of plants from the treated seed-potatoes was just the same as ones grown from the younger seed-potatoes. For examples, the plants treated with 0.1% solution showed the same growth type as the plants produced from the seed-potatoes which were grown in autumn. So the degenerated seed-potatoes may be artificially rejuvenated by the treatment with the solution of α-naphtaleneacetic acid.

3. On the diploid gigus-type selected in the progeny of tetraploid sunflowers. Yakichi NOGUCHI (Ikushu-kenkyu [Researches of Plant Breeding] 4, 105-112, 1950.)

In 1939 a few tetraploid sunflowers were obtained by the colchicine method. All the plants believed the doubling of chromosomes showed the characteristics of tetraploidy, such as gigus-type, large heads and florets, enlargement of seeds, etc. Remarkable reduction of the growth-rate and seed setting, which had frequently been seen in the artificially induced tetraploids, was not observed in this case. The comparative studies on the growth and fertility of diploid and tetraploid palnts have made the relation clearer.

Selections progressed continually with the gigus sunflowers during eight generations to breed good strains of large seed and rich oil content in the seed, namely, to

increase the value as the oil plant. As a result, it was succeeded to get eight promising strains, in which increase in hight of plant (14-41%), diameter of head (47-90%), weight of seed (58-177%), yield bushel per acre (31-63%), oil content in the seed (2-18%) and decrease in fertility (9-30%) have been seen.

All the strains selected were proved as diploid by the examination of chromosome number, so that it may be supposed that the reduction of chromosomes occurred in tetraploid plants induced so many useful variations for breeding according to unstable equilibrium of chromosomes.

The mutants appeared in the progeny of polyploid plant will probably be utilized effectively for the plant breeding in the future.

4. On the concentration of dehydroascorbic acid in lettuce. Tomota SUGAWARA (Journ. Hort. Ass. Japan **19**, 23-28, 1950.)

Five varieties of lettuce, "New York", "Imperial", "May King", "Wayahead" and "Oak-leafed" were used as materials in this experiment. The plants were grown under field condition, and the samples taken with definite intervals in the growing season. The amount of dehydroascobic acid and total ascorbic acid was determined by the titration method with 2.6-dichlorophenol indophenol solutions, described by FUJITA et al.

A considerable amount of dehydroascorbid acid was detected in the fresh blades of lettuce which were just cut (Table 1).

Table 1. Amount of ascorbic acid in lettuce (mg. %).

Varieties	Reduced form	Oxidized form	Reduced form / Oxidized form
New York	25.43	41.24	0.62
Wayahead	27.30	36.90	0.74
Oak-leafed	28.54	44.71	0.64
Imperial	24.71	40.29	0.61
May King	26.00	44.51	0.58

The formation of total ascorbic acid in the leaves is affected by the photosynthetic activity, but no remarkable effect shown on the ratio of ascorbic acid and dehydroascorbic acid. (Table 2).

Table 2. Photosynthetic activity and ratio of reduced form and oxidized form.

Concentration of CO_2 (%)	Absorption of CO_2 (mg. %)	Reduced form (mg. %)	Oxidized form (mg. %)	Reduced/Oxidized
0.035	6.15	26.93	42.25	0.64
0.065	8.48	27.85	42.38	0.66
0.095	10.52	28.76	42.92	0.67

* 50 cm^2 leaf area, 3 hours.

No reaction of enzyme was recognized in synthetic ascorbic acid solutions by adding the juice of plant, the ascobic acid oxydase might be absent in the extracted juice in this case.

5. Studies on the progeny of the fasciated sweet potato. Tomota SUGAWARA (Ikushu-kenkyu [Researches of Plant Breeding] **4**, 75-79, 1950.)

The comparative studies have been made on the difference between the normal strain and the heritable fasciated strain selected from a variety of sweet potato, "Norin No. 4". The fasciation appears in such a type that the stem near the base of vine is almost normal, but it becomes gradually broad bunding toward the growing tip, which terminates with a mass of leaves. In the fasciated strain, the yield of tubers is little inferior, but the content of carbohydrate and crude protein is same in the tuber and evidently superior in the stem (Table 1).

Table 1. Chemical analysis of plant (dry matter %).

Strains	Tuber			Stem		
	Starch	Total sugar	Crude protein	Starch	Total sugar	Crude protein
Fasciated	69.00	5.35	4.66	23.80	11.46	19.66
Normal	73.39	6.14	5.53	13.33	11.15	12.72

No difference is found in the taste of tuber between the two strains. And the yield of tubers increases in the fasciated strain, when it is presented per unit labor; so that the cultivation of the fasciated strain is useful for the labor saving. Moreover, the fasciated strain occupied less space on the field than the normal one and the reduction ratio in yield decreases, when it grows in mixture with soy bean.

6. Studies on the oil formation in rape seeds from the standpoint of crop science. (1) Change of oil content and oil properties in the course of seed development. Sadakichi FUJII and Goro NISHIKAWA (Proc. Crop Sci. Soc. Japan **19** (3-4), 311-314, 1950.)

"Norin No. 5", a variety of rape (*Brassica nupus*), was selected as materials for these experiments. The plants were grown in the pots under the glass-house condition. The pods marked with the date of flowering were collected at 5 days intervals in the progress of seed development for the study. Length and width of the pods or seeds grew rapidly in early stage attained maximum size between 25-30 days after the flowering time. The maximum weight of pods, both fresh and dry, was found on the 40th day after flowering, but the seeds continued to increase their weight during 55 days in the course of development. The oil content of seeds based on dry weight ceased to increase before the weight of seeds reached its maximum, while the total weight of oil per 1000 dry seeds continued to increase. The iodine value and refractive index of extracted oil decreased in the progress of seed development, but they began to increase after the completion of deposit of oil.

7. Studies on the development of peanut seeds. (2) Effect of soil moisture on the oil formation. Goro NISHIKAWA and Tozaburo MIKAMI (Proc. Crop Sci. Soc. Japan **19** (1-2), 133-136, 1950.)

The effect of different condition of soil moisture (50% and 30%) since the 56th day after flowering, when the change of iodine value seen in the previous investigation, upon the development of peanut seed, especially with oil and protein content in the seed and iodine value of oil at the 84th day after flowering, when the seed was

harvested, was made clear in this study. Under the dry condition of soil with 30% moisture, the growth of main stem was retarded and the number of flowers decreased slightly, but the elongation was recovered when the soil moisture changed from 30% to 50%. The slower growth of gynophore was observed under the dry condition, but its end enlarged quickly as soon as penetrated into soil to produce the seeds in it. The good production of peanut seeds with rich oil content was obtained on the well-moistured soil, while the high protein content and iodine value were produced contrary under less-moistured soil condition.

8. On the effect of soil moisture in the development of soybean seeds. (Preliminary report) Yomisu OKAMOTO (Proc. Crop Sci. Soc. Japan **19** (3-4), 315-318, 1951.)

"Norin No. 1", a variety of soybean, was selected as material in this experiment. The plants grown with 50-60% soil moisture until 3 days before flowering were divided then into three parts and kept under the different moisture condition of soil such as (I) 90-100%, (II) 65-75% and (III) 35-45% at the maturation period.

The results are summarised in the following table.

Items	Superior	Medium	Inferior
Weight of top (air dry)	II	III	I
Weight of root (air dry)	II	I	III
Top root ratio	III	II	I
Development of roots	–	–	II
Weight and diameter of stem	II	I	III
Number of vasculer bundle in stem	III	II	I
Number and weight of pods per plant	II	III	I
Weight of seed	II	III	I
Oil content in seed	I	II	III
Protein content in seed	III	II	I

As the results show, it seems that the most suitable moisture content in the soil for growth and yield of soybean is about 65-75%, but such a condition of soil moisture is somewhat inconvenient for the formation of seed.

9. Studies on the effect of flooding irrigation for rice plants. (1) The effect of continuous flooding upon the growth and the structure of culm of rice plants. (Preliminary report) Kanoe SATO (Proc. Crop Sci. Soc. Japan **19** (1-2), 45-48, 1950.)

On the paddy field it is common to have the flooding during the most part of growing season of rice plants. There have been many observations concerning the meaning of flooding, but the investigation has not been as yet to make clear the effect of flooding upon rice plants. In these experiments the rice plants were grown in WAGNER'S pots; flooding plots being kept in water 7 cm thick continuously and the controls being irrigated in the saturated condition. The results obtained are as follows:

(1) In Kanto District the air temperature of early growing season of rice plants is rather low, hence the continuous flooding promotes the growth according

to its superiority of water temperature. But later in summer, the soil aeration seems to become an important factor, and the flooding is rather disadvantageous for the growing of rice plants.

(2) Flooding affects the structure of the lower portion of stem and weakens it mechanically; the weakness may be chiefly due to the thin wall and defect of mechanical structure of culm.

10. On a dwarf semi-sterile rice plant with disclosing flowers. (1) Growth of the plant and characteristics of its panicle and spikelets. Kanoe SATO (Proc. Crop Sci. Soc. Japan **19** (3-4), 243-246, 1951.)

In 1948, a dwarf semi-sterile rice plant was found in a variety "Ginbozu", which had been grown in the Faculty of Agriculture. It may be induced as a mutant, because its offsprings showed such peculiar characters as follows:

(1) The height of seedlings is little shorter than normal form caused by their short length of sheath, but late in maturity the short stalks draw our keen attention. The colour of leaves is darker and near the top of blade appear remarkalbe wrinkles.

(2) As only about one-third of spikelets produces small matured seeds and the culms are rigid, the ears stand upright at the harvest time. Consequently, the plants do not turn yellow and many new branches or tillers are produced vigorously on the way to maturity even at higher nodes of culms.

(3) The lowest node of a panicle has rarely lateral branches or often degenerated leaf and seldom emerges from the sheath of boot-leaf. As the nodes in a panicle are few and the lateral branches are somewhat little in comparing with those of normal, each node except the lowest one has 2-4 lateral branches, and the internodes are irregular in length. The arrangement of spikelets is also lacking in uniformity.

(4) Normal flowers and seeds on the dwarf plant are much smaller than those of normal form; the parts of flowers such as glumes and stamens are very short. Most of the flowers have relatively too small palea except a few extremely deformed ones which have a longer palea than lemma, thus there is found a gradation in the size of palea. As a result of this disproportion of both glumes, the hull does not close or fit tightly and sometimes remains open after flowering.

(5) As anthers, pollens and pistils seem to be normal in their shape and activity, the sterility might chiefly be caused by the disproportion of size of glumes; during panicles are still in the sheath of boot-leaf, the anthers of flowers disclosed already are destroyed by water drops in the sheath; after heading, the air gets in freely inside of glumes causing interference in the development of ovules fertilized by dryness, and often rain-drops too destroy the pollens before pollination.

The genetical study of these characters mentioned above has been in progress since 1949.

11. Hunger signs in several vegetable crops. Tadayoshi SUGIYAMA and Masatoshi IWATA (Journ. Hort. Ass. Jap. **19** (2), 113-124, 1950.)

Turnips, spinaches, carrots, cabbages and potatoes were grown in pots containing the soil, which is loamy subsoil of ANDO type and very low in available phosphorus and nitrogen, medium in potassium. Various fertilizer treatments were applied, and deficiency symptoms of nutrient elements revealed in the vegetable crops were observed. Cabbage plants were chemically analyzed after harvesting. The results obtained are as follows:

Nitrogen deficiency: the plants grew very slowly, and their leaves were small and pale in color. In cabbages anthocyan pigments had developed on their stems and leaves.

Phosphorus deficiency: the plants grew also very slowly, and their leaves were small, as in the case of nitrogen deficiency, but were dark green in color in contrast to the nitrogen deficient ones. In cabbages anthocyan pigments had developed.

Potassium deficiency: the symptoms developed after the plants had grown for a while without any sign of dwarfing. In turnips and spinaches, the leaf color became dark and older leaves were scorched from their margin and later dried up.

Potassium contents in the potassium deficient cabbages were very low, while nitrogen and phosphorus contents were not so significantly affected in the plants deficient in the elements.

The root color and the proportion of core in the carrots were not affected by deficiencies in any elements, excluding the very small plants in which the root color were poor.

12. Hunger signs in vegetable crops. II. Tadayoshi SUGIYAMA, Masatoshi IWATA and Toranosuke SHICHIJO (Journ. Hort. Ass. Jap. 20 (2), 89-97, 1951.)

Deficiency symptoms of essential elements were observed in tomatoes, radishes, cabbages and onions by the water and sand cultures. The results obtained are as follows:

Nitrogen deficiency: the plants were dwarfed and had small, yellowish leaves. In radishes and cabbages, the red color was intensified due to development of anthocyan pigments. The roots were white and healthy.

Phosphorus deficiency: the plants were dwarfed and rather thin; the leaves were small and dark green. Anthocyan pigments had developed in cabbages. In tomatoes, petioles of young leaves attached to the stem with narrow angles; leaflets curved to the underside; leaf veins were reddish. The roots developed poorly and were reddish-brown in color.

Potassium deficiency: the early growth was not affected, but later the plants were severely affected and dwarfed. In radishes and cabbages the leaf margin of older leaves turned to greyish brown and dried out. Younger leaves affected progressively and lower leaves dropped off. In onions, interveinal portions of outer leaves turned to brown color longitudinally and later tips withered and dried up. In tomatoes, potassium deficient plants were small but did not revealed and sign of specific symptoms.

Calcium deficiency: in tomatoes, growth points were dead and the stem elongation had consequently ceased; leaves curled upwards. In the other crops, plants had dwarfed but not specific symptom had been developed.

Magnesium deficiency: the early growth of magnesium deficient plants was excellent as the normal plants. In the later stages yellow patches had developed between large veins of older leaves. In tomatoes, petioles of the older leaves attached to the stem with very wide angles. In cabbages, older leaves abscissed prematurely. In onions, no specific symptoms had developed, but plants felt rather soft. After specific symptoms had developed, the plant growth was drastically retarded.

Sulfur deficiency: lower leaves turned slightly to lighter color, and red pigments had developed in the leaves and veins in tomatoes.

Iron deficiency: interveinal portions of the young leaves turned to yellow, while narrow portions along the veins remained green. Later young leaves turned to pale

yellow. At first the leaf size was not so affected, but later the growth was checked severely.

Boron deficiency: stem tips of tomatoes had died. In onions, the growth was poor, but did not developed any specific symptoms.

Deficiency symptoms of manganese, zinc, copper and molibdenum did not developed in this experiments; it may be due to the impurities contained in the sand, chemicals or water used. It seems that some specific treatments are necessary for the studies on such micro elements.

Cabbage plants were analyzed for their N, P, K, Ca, Mg and S contents. K, Ca, and Mg contents in the plants which were deficient in the named elements were significantly low, while N, P and S contents of the plants which were deficient in these elements were not so signficantly affected. It seems that the former elements may not be so essential for growth, but as their contents dropped to certain critical levels, the physiological functions are drastically affected, symptoms may be revealed, and the growth may be checked. Ca, B and Fe deficiency symptoms developed at the young portions in contrast to the case of N, P and K deficiencies. It may be probable that these elements can not be mobilized so easily to the young portions from the older portions.

13. On the pollen and its germination of Japanese lawn grass. Teizo NIWA (Journ. Jap. Inst. Landscape Architects **13** (2), 4-6, 1950.)

The Japanese lawn grass, both *Zoysia japonica* and *Z. tenuifolia*, are sterile in general. Sometimes as much as 60% of seeds are immature, and the rate of germination is very low (below 5%). Three points can be considered at least for the cause of sterility, such as (1) defects of pollen, (2) defects of the pistil and (3) physiological defects in the process of fertilization.

At first, the germination of pollen was investigated on the nutrient media contained agar, cane sugar and distilled water at the rate of 1:30:100 (in weight). The fact was made clear that under the condition of 20°C., 14.4% of *Z. japonica* pollen and 8.1% of *Z. tenuifolia* pollen produced the pollen-tubes, and the germination was not inferior to those of some species in Graminaceae (*Oryza sativa* L., *Horcus Sorghum* L. and *Zea Mays* L.).

14. On the propagation of Japanese lawn grass with seeds. II. Teizo NIWA (Journ. Jap. Inst. Landscape Architects **14** (1), 1-5, 1950.)

Soaking the seeds of *Zoysia japonica* and *Z. tenuifolia* in the 1/30,000 (in weight) solution of heteroauxin and in that of α-naphthaleneacetic acid for 72, 48, 24, 12 and 6 hours and 1/50,000, 1/30,000 and 1/10,000 solution for 24 hours respectively.

It was succeeded that the percentage of germination raised up to 23%, eight times of the percentage in natural condition in *Z. japonica* and 11.8%, 4 times in *Z. tenuifolia* by soaking the seeds in 1/30,000 solution of heteroauxin and α-naphthaleneacetic acid for 12 hours.

15. On the "Kawara-no-in" Garden. Matsu YOSHIKAWA (Journ. Jap. Inst. Landscape Architects **13** (2), 7-20, 1950.)

The "Kawara-no-in" Garden was laid out during 872-879 A.D., in the lot of the official residence of the Senior Minister ("Sa-daijin") Minamoto-no-Tōru. The garden of "Kikokutei" (the Shōsei-en") has long been believed to be the site of the ruined garden of the "Kawara-no-in", but careful references to literatures have certified that the site of the "Kawara-no-in" had situated about 200 meters north of

the "Shōsei-en" with the area of about 400 ha. The motive of the garden making—an imitation after the scenery of the beach of "Shiogama"—was based upon the poetic life of the "Heian" monarchical days. After the thorough desolation of the garden, many episodes were fabricated during 700 years, and the legendal form of the garden was completed in a "Noh" play, "Tōru". After an examination of considerable amount of literatures about the original style of the garden, only three poems were found among them which can provide the real aspect of it, which certify only two points—(a) the pond of the garden was imitated after the beach of "Shiogama" with an islet representing "Magakijima" Island which lies in the Bay of Shiogama and (b) the smoke from boiling salt-water in the garden brought forth a topographical atmosphere of the beach. After Tōru was dead, the "Kawara-no-in" was use as a temporary palace of the Retired Emperor Uda for about 30 years. And then poem-parties were frequently held in the garden by the courtiers till about 950 A.D. In the history of Japanese landscape gardening, the "Kawara-no-in" Garden is significant for the following three reasons—(a) it is one of the oldest laid out in imitation after a singular landscape of Japan, (b) the way of the imitation was not merely realistic but metamorphic and (c) thus the style of the Japanese gardens has gradually developed out of the Chinese influences.

16. Studies on the classification of potato viruses. I. On the virus from apparently healthy potato of variety "Danshaku". Hidefumi ASUYAMA and Yasuo KOMURO (Contr. Plant Viruses and Virus Diseases. pp. 4-12, 1950.)

In Japan, "Danshaku", an old variety introduced from U.S.A., is grown most extensively. Whether apparently healthy plants of this variety are infected by a latent virus or not is confirmed.

By means of carborundum inoculation, the extract from an apparently healthy potato of "Danshaku" produced symptoms of faint mottle on tobacco and of distinct veinbanding, veinclearing and mottle on *Datura* plants. The pressed juice from each of 32 apparently healthy potato plants induced similar symptoms on *Datura* plants. The virus in question is readily transferred by rubbing, but not transmitted by means of *Myzus persicae*. The following ten solanaceous plants are shown to be susceptible to this virus. The symptoms produced consisted of veinbanding, veinclearing and mottling. *Nicotiana tabacum* var. *Turkish*, *N. glutinosa*, *N. longiflora*, *Datura stramonium* *Lycopersicum esculentum*, *Solanum nigrum*, *S. melongena*, *Capsicum annuum* var. *grossum*, *Physatiastrum chamaearachoides*, and *Physalis angulata*. When tobacco plants previously infected by the present virus were inoculated with potato Y-virus in succession, they revealed rugose symptoms. Tomato plants similarly showed symptoms of the streak as a result of inoculation with a complex of the present virus and tobacco mosaic virus. The juice from tubers either before planting or immediately after digging was found to be infective to *Datura*.

The virus produced infection after heating for 10 min. at 70°C, but was inactivated at 75°C. It caused infection when diluted up to 1 to 10,000. The virus retained its infectivity in vitro for 96 days, but was inactivated after 122 days. The virus is filtrable through the Shofu filters L_3 and L_5, by which the infectivity was reduced remarkably. From the results obtained, the virus from the apparently healthy plants of "Danshaku", seems in every respect, to be identical with a mild mottle strain of potato X-virus (Solanum virus 1).

17. A mosaic disease of Komatsuna (*Brassica rapa* L. var. *Kamatsuna*).

Hidefumi ASUYAMA and Takeo KASAI (Contr. Plant Viruses and Virus Diseases. pp. 37-50, 1950.)

The symptoms of Komatsuna mosaic are characterized by veinclearing of the leaves in early stages of infection followed by chlorotic veinbanding, mottling with raised islands, malformation and stunting of the plant. X-body has not been observed in the mottled leaf tissues.

Greenhouse experiments showed that this mosaic virus was transmitted by aphids, *Myzus persicae* SULZ. and *Rhopalosiphum pseudobrassicae* DAVIS, and also readily by mechanical inoculation with carborundum. The incubation period ranged from 8 to 15 days. Tests for seed and soil transmission yielded negative results.

The host range of the Komatsuna mosaic virus included 15 species of plants representing 7 genera in 5 families. Among the cruciferous crops, infection was obtained on Mizuna (*Brassica japonica* MAKINO), Chinese mustard (*B. juncea* COSS.), Santosai (*B. pekinensis* var. *dentata* MATSUM. et NAKAI), yellow mustard (*B. cernus* FORBES et HEMSL.), Taisai (*B. parachinensis* BAILEY), rape (*B. napus* L.), turnip (*B. rapa* L.), Chinese cabbage (*B. pekinensis* RUPR.), cabbage (*B. oleracea* L.), Japanese radish(*Raphanus sativus* L. var. *longipinnatus* BAILEY), radish(*R. sativus* L.) and stock (*Matthiola incana* R. BR.).

Komatsuna mosaic virus is inactivated by heating for 10 minutes at 65°C, by diluting up to 1 to 14,000 and by treating with absolute ethyl alcohol for 2 hours.

Precipitin techniques, particularly by cross and absorption precipitin tests, have been applied to recognize the difference between the Komatsuna mosaic virus and Japanese radish stunt virus which is prevalent in Shizuoka Prefecture. These viruses, however, were found almost indistinguishable by this test. The compliment fixation tests obtained negative results. Further, the present virus has been proved to be serologically distinct from tobacco mosaic virus.

As a result of comparison of the symptoms, host range, physical properties and serological relation, the Komatsuna mosaic virus is regarded to be identical with or very closely related to the Japanese radish stunt virus, described by ISHIYAMA and MISAWA (1943).

18. Studies on the classification of potato viruses. II. A complex of viruses inducing crinkle mosaic of potato variety "Benimaru". Hidefumi ASUYAMA and Yasuo KOMURO (Ann. Phytopath. Soc. Japan. **15** (2), 49-54, 1951.)

The nature of the virus inducing the crinkle mosaic in the potato variety "Benimaru" is as follows. Mottling of the upper six to seven leaves is distinct throughout the entire growth stages of plant, although it may be masked in the hot season. It is followed by waviness of margins of leafiets. No streak was observed during the course of the experiment. Transmission experiments have proved that the causal virus is a complex of X-virus which is transmitted only by sap inoculation, and Y-virus which is transmitted by means of aphids as well as mutilation method. On inoculating with X+Y viruses or with Y-virus alone to apparently healthy plants of "Benimaru", symptoms similar to the original crinkle mosaic were produced. The apparently healthy plants of "Benimaru" variety were demonstrated to be infected by a mild strain of X-virus.

As a result of artificial inoculations, Turkish tobacco, *Nicotiana longiflora* CAC., *N. glutinosa* L., tomato and *Solanum nigrum* L. were found to be infected by both X- and Y-virus. *Datura stramonium* L., pepper (*Capsicum annuum* L.) and eggplant were susceptible to X-virus, but not to Y-virus.

Inoculations with juice from the affected tubers shortly after harvest, or stored tubers immediately before planting, succeeded in producing infection of tobacco plants by Y-virus, though the percentage of successful inoculation was lower than that by X-virus.

The X-virus used in this experiment is tolerant to heating at 70°-75°C for 10 minutes, to a dilution of 1:100,000 and to aging in vitro for 72 days, it passed through the ZEITZ filter L_3 (Shofu). Y-virus is tolerant to heating at 55°-60°C for 10 minutes, to a dilution of 1:500-1,000, and to aging for 1-2 days. It did not pass through ZEITZ filter L_3 (Shofu).

19. On the streak disease of a variety of potato "Norin No. 1". Kiyoshi YORA and Yasuo KOMURO (Ann. Phytopath. Soc. Japan. **14** (1-2), 23-24, 1950.)

The streak disease has been often noticed on potato plants of "Norin No. 1" in the field. The typical symptom is a leaf-drop streak type and very similar to the acropetal necrosis caused by potato virus Y, of which the description has been found with some of the European potato varieties. Mechanical inoculation with the expressed juice produced necrotic spots and streaks on X-virus-free potato plants of "Norin No. 1", and veinclearing on Turkish tobacco (Xanthie variety) and *Nicotiana glutinosa*, while it caused no infection of *Datura stramonium*. These evidences show that the virus associated with the streak is potato Y-virus. The same symptom of leaf-drop streak, however, was induced when plants of "Norin No. 1" were infected by a complex of potato X- and Y-virus.

20. On the simple mosaic of a variety of potato, "Norin No. 1". Kiyoshi YORA (Ann. Phytopath. Soc. Japan. **14** (3-4), 75-78, 1950.)

The potato tubers of the following three varieties, "Danshaku", "Benimaru" and "Norin No. 1", were tested for the infection by virus X, by the inoculation with expressed sap of the tubers on *Datura stramonium*. The tested tubers were planted in the greenhouse. All the plants of the former two varieties were found to be infected with potato virus X in spite of their healthy appearance, but a few plants of "Norin No. 1", on the contrary, were infected by X-virus and all of them showed very mild mosaic symptom. These mild mosaic plants were proved to be free from potato virus Y. When inoculated with potato virus X, potato plants of "Norin No. 1" grown from tubers as well as true seeds, showed the same mild mosaic symptom as in naturally infected plants. This mild mosaic corresponds apparently to the simple mosaic described by P. A. MURPHY and R. McKAY (1924) and T. P. DYKSTRA (1939). The symptom is very mild and often restricted to the lower old leaves, but the virus concentration in the upper, apparently healthy leaves, is as high as in the lower, mosaic leaves. The X-virus isolated from the simple mosaic plants of "Norin No. 1" was very severe in its pathogenicity on *Datura stramonium*, and produced severe mottling, yellowing, and necrosis. It may be a severe-type of mottle strain different from ordinary mottle strain isolated from "Benimaru" and "Danshaku".

21. Studies on the acting mechanism of insecticides. (I) The actions of some sympatho- and parasympathomimetic drugs and insecticides on the heart of an insect, *Locusta migratoria danica* L. Teruo YAMASAKI and Toshio ISHII (Ōyō-kontyu **5** (4), 155-168, 1950.)

The actions of some sympatho- and parasympathomimetic drugs, i.e. acetylcholine, eserine, atropine, adrenaline, DDT and BHC on the exposed heart of grasshopper, *Locusta migratoria danica* L. have been studied.

Acetylcholine has a stimulating action. In low concentrations (10^{-6}-10^{-10}), it augments the intensity of beat or frequency, or sometimes both of them. In high concentrations (10^{-4}-10^{-5}), it may produce a tetanic-like systolic stoppage. This effect is reversible when the drug is replaced by the fresh RINGER'S solution. Eserine solution (10^{-4} or 10^{-5}) does not potentiate the action of acetylcholine on the heart of the insect. Atropine (10^{-4} or 10^{-5}) depresses completely the effect of acetylcholine. Adrenaline (10^{-5} or 10^{-6}) has a stimulating action on the heart. Simultaneously with the irregular and violent tetanic contractions of the alary muscles and the abdominal muscles brought about by the perfusion of DDT suspension (0.01%, 0.001% or 0.0001%), the heart beat is irregularized and the frequency decreases in a remarkable degree, although the intensity of beat does not reduce markedly. The contractions of these muscles are abolished soon after in most cases, and the heart continues to beat for many hours with lower frequency of beat. These effects of DDT are not reversible when the drug is replaced by the fresh RINGER'S solution. BHC (0.01%) has no remarkable effects on the heart beat. Acetylcholine produces the usual effect on the heart which is treated with DDT (0.01%) for half an hour, but after the heart continued to perfuse with DDT suspension for three and half an hour, it reduces the sensitivity to acetylcholine. But this reduction of the sensitivity is not identical with that of BHC treated heart.

22. Studies on the acting mechanism of insecticides. (II) The action of DDT on the heart of an insect, *Allomyrina dichotomus* L. Teruo YAMASAKI and Toshio ISHII (Ōyō-kontyu 6 (3), 127-132, 1950.)

A method of mechanocardiographic recording of the beat of the exposed insect heart, using larvae of *Allomyrina dichotomus* L. has been presented. In this method the light lever is used, so the resistance caused by friction is very small and the beat can be exactly registered.

The effect of DDT on the exposed heart of the larvae of *Allomyrina dichotomus* L. has been studied by the method. The course of DDT effect can be devided into the following five periods.

1st period: A few minutes after the treatment, the frequency of beat is decreased, and the beats are irregularized.

2nd period: 10-20 minutes after the treatment, the frequency is restored to the pre-treatment level or still slightly higher.

3rd period: the frequency is gradually decreased.

4th period: a strong contraction of abdominal muscles occurs, and the beat is very slow.

5th period: both the beat and the contractions of abdominal muscles are nearly stopped.

When 0.005% or a lower concentration is used, the larvae are kept at the forth or earlier periods for a few hours and the stoppage of beat can not be observed.

In comparison of the effects of DDT on the hearts of insects, adults of *Locusta migratoria danica* L. and larvae of *Allomyrina dichotomus* L., the following assumption can be reliable. It is reported that the beats of those hearts which possess heart ganglia are accelerated by acetylcholine and those which have not them are inhibited or unaffected in invertebrate animals. It is supposed that in the former the heart beats are of neurogenic origin and in the latter they are of myogenic origin. The hearts of adult insects posses ganglia and are accelerated by acetylcholine while the

hearts of larvae lack ganglia and are unaffected by acetylcholine. So it is probable that in the case of grasshopper DDT severely attacks the neurogenic heart mechanism and decreases the frequency of beats markedly, while in the case of *Allomyrina* larvae the beats are of myogenic, so that the effects of DDT are relatively small.

23. **Studies on the amino acids in the silkworm. I. On the free amino acids in the silkworm egg.** Narumi YOSHITAKE, Hisao ARUGA and Yoshizumi SUZUKI (Journ. Seric. Sci. Japan **19** (6), 530-532, 1950.) **II. On the free amino acids in the integument of the silkworm larva. III. On the free amino acids in the blood of the silkworm larva. IV. On the free amino acids in the silkworm faeces. V. On the free amino acids in the pupa and moth.** Narumi YOSHITAKE and Hisao ARUGA (Journ. Seric. Sci. Japan **19** (6), 532-540, 1950.)

These studies are a part of the investigations in used several mutants (+ p, p^s, od, lem, w_1) from the standpoint of the physiological genetics of the silkworm to clear the relations between uric acid, riboflavine, pterin and some melanins.

The free amino acids in the eggs, larvae (integument, blood and faeces), pupa and moth have been discliminated by paper chromatography. The results are shown in Table 1.

Table 1. The free amino acids in the silkworm.

Free amino acids	Egg	Integument	Blood	Faeces	Pupa	Moth
Phenylalanine	+	±	+	+	+	+
Leucine	+	+	+	+	+	+
Valine	+	+	+	+	+	+
Tyrosine	+	±	+	+	+	+
Proline	+	−	+	−, ±	+	−, ±
Glutamine	+	−	+	+	+	+
Histidine	+	+	+	+	+	+
Alanine	+	+	+	+	+	+
Arginine	+	±	+	+	+	+
Threonine	+	−	+	−, ±	+	+
Glycine	+	+	+	+	+	+
Glutamic acid	+	+	+	+	+	+
Aspartic acid	+	+	+	+	+	+
Serine	+	+	+	+	+	+
Cystine	+	+	+	−, ±	+	−, ±
Unknown spot	4	1	3	0	4	3

The quantitative changes of some free amino acids in the eggs with the development of the embryo are recognized (Table 2).

It is remarkable that tyrosine and phenylalanine have scarcely been detected in the larval integuments excepting the moulting stages. The changes of leucine, phenylalanine, tyrosine, valine and proline during the period from pupation to eclosion are shown in Table 3.

Table 2. Changes of the free amino acids in tha eggs with the development.

Free amino acids	in the pupa	14 hours after laying	30 hours after laying	4 days after laying	7 days after laying	10 days after laying
Tyrosine	⧻	⧺	+	±	+	+
Proline	−	−	±	+	+	⧺
Phenylalanine	±, +	+	⧺	⧺	⧺	⧺
Leucine	±, +	+	⧺	⧺	⧺	⧺
Valine	±, +	+	⧺	⧺	⧺	⧺
Glycine	+	+	⧺	⧺	⧺	⧺

Table 3. The quantitative changes of the free amino acids from pupation to eclosion.

Free amino acids	Days after pupation					Moth
	0	2	4	6	8	
Phenylalanine	+	+	+	+	±	±
Leucine	+	+	+	+	±	±
Valine	+	+	+	+	±	±
Proline	+	+	+	+	−, ±	−
Tyrosine	+	+	+	+	⧺(♀), ±(♂)	±
Histidine	+	+	⧺	⧺	⧺	±

The qualitative differences of the free amino acids between five mutants used in these investigations have not been recognized.

II. Agricultural chemistry

Abstracts Nos. 24—92

24. Studies on the maturing process of newly reclaimed soils. II. On the transition of the type of phosphate absorption of soils. Kenzo KOBO and Kei AKATSUKA (Bull. Physiographical Sci. Res. Inst. **5**, 1-5, 1950.)

Treating many kinds of soils with phosphoric acid solutions of which pH have been regulated with KOH, Dr. SHIOIRI (1935) studied the relations between the pH of the filtrate and the amount of phosphoric acid absorbed by soils, and showed that there were four types in phosphate absorption; he indicated that three types of these were revealed by siallitic soils and a forth one was that of allitic soil.

After SHIOIRI's method, a type of phosphate absorption of soils which belonged to the allitic soil was studied in comparing the characteristics of uncultivated soils with the adjoining long cultivated soils. With the results of these researches, the following facts were acknowledged:

(1) Uncultivated soils, deficient in exchangeable calcium, put forward the 4th type of phosphate absorption, but with the progress of cultivation accompanying the increase of exchangeable calcium, the type of phosphate absorption approaches to the 3rd type.

(2) In the case when the exchangeable calcium does not increase so much and the isoelectric point of soil, which is estimated by electroendosmosis, does not fall below pH 3 even after long cultivation, shifting to the 3rd type is not consummated.

(3) Uncultivated soil rich in exchangeable calcium has the property that shows the 3rd type of phosphate absorption, and after reclamation, the soil rather seems to have an inclination to go backward to the 4th type, accompanying the decrease in exchangeable calcium.

Formerly KOBO showed that the humus of uncultivated soil poor in exchangeable calcium is mainly rotted products, but that as a result of the increase of exchangeable calcium after reclamation the humus is transformed into the true humic acid and the pH of isoelectric point of soil goes down; these facts indicate the formation of humosilicate complexes and the disappearance of the allitic properties of soils.

The transition of the type of phosphate absorption of soil from that of allitic soil to that of siallitic soil is due to the rise of acidoid/basoid ratio of colloid on the basis of the formation of true humic acid. This fact may also indicate the formation of humosilicate complexes.

25. Studies on the maturing process of newly reclaimed soils. III. Change of base exchange capacity and isoelectric point in the maturing process. Kenzo KOBO (Journ. Sci. Soil and Manure, Japan. **21** [2], 107-112, 1950.)

The maturing process of newly reclaimed soils is said to be the process in which forest soil converts to steppe soil, and especially dilluvial volcanic ash soil which occupies a large area among the land to be reclaimed in our country, that is also the process of diminishing allitic properties. Formerly KOBO proved that rotted porducts diminish and the form of humus stabilizes after reclamation, and assumed that this stabilization of humus was to contribute to form humosilicate complexes.

In these researches of carbon contents, base exchange capacities and isoelectric points in comparing uncultivated soils with the adjoining long cultivated soils, the author have come to acknowledge the following facts:

(1) In the maturing process of newly reclaimed soils, humus contents tend to decrease, but no seeming changes are found in the base exchange capacity.

(2) Humus which decreases after reclamation, namely rotted products, has a small base exchange capacities, and the diminution of the base exchange capacity of soil as a result of decrease of humus is compensated by the increase of the base exchange capacity of clay itself, which is brought about by the formation of humosilicate complexes after the stabilization of humus.

(3) When uncultivated soils, poor in exchangeable calcium, were reclaimed and cultivated for several years, isoelectric points of its surface soil together with subsoil are lowered with the increase of the exchangeable calcium.

The above facts may verify the fomation of humosilicate complexes in the maturing process of the newly reclaimed soils.

26. Investigation on humus of paddy soils. (2) Types of humic acid. Kyoichi KUMADA (Journ. Sci. Soil and Manure, Japan. **21** [3], 171-174, 1951.)

The types of humic acid of the paddy rice soils were investigated. The results are summarized as follows:

(1) Humic acid extracted with NaF from soil were chiefly composed of SIMON'S true humic acid, both type A and B.

(2) In general, relative color values (SIMON'S RF) of humic acid extracted with NaOH from soil, were lower than those of humic acid extracted with NaF. But in some cases, there were found soil having humic acid probably belonged to true humic acid, predominently type A.

(3) In a soil, where a large quantity of lime was fertilized for many years, and soil reaction had become alkaline, humus have had properties like those of chernozem.

27. Dynamic studies on the nutrients uptake by crop plants. Part I. The nutrients uptake of rice root as influenced by hydrogen sulfide. Shingo MATSUI Sueo ASO and Kikuo KUMAZAWA (Journ. Sci. Soil and Manure, Japan. **22**, 46, 1951.)

In the course of some dynamic studies of the nutrients uptake by crop plants, the result of the nutrient uptake of rice crop as influenced by hydrogen sulfide may be summarised as follows:

(1) Hydrogen sulfide was bubbled through the water culture solution for about ten minutes in which the root of rice plant was immerced. In one case, the initial pH of the culture solution was controlled to 7.0 and 4.5 respectively. In every case the uptake of NH_4-N and water was depressed seriously, though the effect was always more pronounced for NH_4-N than H_2O.

(2) The effect of concentration and the period of contact of H_2O-H_2S was studied with rice seedlings. The seedlings were grown in an artificially controlled room (light and temperature) and the effect was conveniently observed through the percent increase of the wilted leaves, which was the definite sign of the reduction in absorption.

The injury was enhanced on the prolonged contact or the increased concentration; the wilting at last appeared in 288 hours even by the extremely dilute concentration of 0.07 ppm as S.

(3) Hydrogen sulfide was bubbled through the water culture solution as in (1) and the results of the uptake of NH_4-N, CaO, Sio_2, MnO, MgO, P_2O_5 and H_2O were tested statistically. In general, they were highly significant enough to permit definite conclusion. The treatment reduced the uptake in the following order $P_2O_5 > K_2O > SiO_2 > NH_4$-N $>$ NnO $> H_2O >$ MgO $>$ CaO. The order of P_2O_5 should be questioned, as it was evident that some P_2O_5 temporarily adhering to the surface of the root as basic phosphated iron could have entered into the solution on H_2S treatment. The result was discussed in two ways. Practically, it seems to permit more logical interpretation of the mechanism, why the severe attack of *Helminthosporium* leaf spot predominates in the poor productive paddy rice field in Japan, where the evolution of hydrogen sulfide is believed to injure the rice root on account of the lack of active iron in the soil (a kind of podsolisation). The relatively strong reduction in absorption in such elements as K_2O, SiO_2, NH_4-N, MnO as compared to H_2O, MgO, CaO concurs with the several investigations which point to the high correlation between the deficiency of these elements and the occurrence of the named desease.

Theoretically, however, the result must be nothing but the reduction of the "metabolic absorption" as proposed by HOAGLAND and his associates, on the more or less interruption of which the pure physicochemical characteristic properties of ions,

in thtis case "hydration", might have substantially affected the ion absorption in the order of the well-known lyotropic series. In fact, as for those elements to which the lyotropic series are generally unquestionable the order of the reduction of ion absorption was $K_2O > NH_4\text{-}N > MgO > CaO$.

28. Utilization of N^{15} as tracer element in the studies of nitrogen transformation in the soil. Shingo MITSUI and Kan-ichi OTA (Journ. Sci. Soil and Manure, Japan. **21**, 83, 1950.)

Heavy nitrogen isotope of 5.67 atom % N^{15} excess in the form of ammonium sulfate was added along with some soluble starch to the soil, previously air dried and not dried respectively. The soils were incubated three weeks at 30°C under waterlogged condition followed by the analysis of NH_4-N, humic-N, non-humic-N (Hopson-Page) contents.

As revealed by mass-spectrum analysis of N^{15} the nitrogen fractions in the humic and non-humic N originated from the inorganic N were considerably high, the effect of air drying resulting in the less transformation in the organic nitrogen as compared with non-drying.

The analitical results were discussed in comparison to the ordinary method of substraction (plot in question—check plot), the latter undoubtedly gave unreliable results.

29. Studies on nitrogen metabolism of rice plant with use of isotopically labelled ammonium sulfate (I-II). Kiyoshi OZAKI and Shingo MITSUI.

Part I. (Journ. Sci. Soil and Manure, Japan. **21**, 86, 1950.)

Rice plants were supplied 14 days before heading with $(N^{15}N_4)_2SO_4$ containing 5.67 atom per cent excess. At the periods of heading and full mature, plants were harvested, separated into several parts, and analyzed for their nitrogen content and concentration of N^{15}.

The high level of N^{15} in ears, culms, and boot leaves at heading as contrasted with other parts, and the comparison of N^{15} concentration between two periods suggested that the principal parts of N^{15} were utilized as raw materials for the growth of those organs which were at their highest activities.

N^{15} which translocated in the leaves at heading was regarded as storage nitrogen, because it was gradually removed to other parts.

In the roots N^{15} were utilized both for the formation of new roots and storage nitrogen.

Part II. (Ibid. **21**, 179, 1951.)

The utilization of nitrogen supplied after heading by rice plant was studied using labelled ammonium sulfate. When the plant is harvested, 35% of this nitrogen is distributed in the ears. The isotope concentration of various proteins in the brown rice is almost equal except prolamin. The relationship between these results and nitrogen translocation in the plant during the maturing stage is discussed.

30. Colorimetric determination of potassium with dipicrylamine. Tomoyoshi KIUCHI (Journ. Sci. Soil and Manue, Japan. **20**, 164, 1950.)

Colorimetric determination of potassium with Na-Dipicrylaminate was performed by using the Stufenphotometer. The principle of this determination is identical to AMDUR'S method. But the Stufenphotometer was used in the place of electrophotometer. Therefore, the most convenient condition for Stufenphotometry was

investigated. The result was as follows:

The filter: S 47.

Thickness of solution: about 30 mm.

Concentration of reagent: 0.3-0.8% solution of Na-dipicrylaminate.

Concentration of solution for colorimetry: 0.3 cc of supernatant liquid of excess Na-dipicrylaminate sol/100 cc of distilled water.

The effects of foreign ions on this method were discribed below. Na, Ca, Mg does not interfere with the determination of potassium with the exception of large amounts of them. Using 0.5 mg K the author determined the potassium with accuracy of ±2.5% in the presence of 10 mg Na, Ca, Mg. By this method the determinations of potassium in the plant tissues were made, and their errors were also within ±2.0%.

This method will be applicable for the Duboscq colorimeter. The Stufenphotometer reading ($I/I_0 \times 100$) is substituted with the reading of Duboscq colorimeters scale which indicates the depth of 0.02% potassium bichromate solution when both halves of the field appear equally bright. The depth of Na-dipicrylaminate solution for making standard curve is fixed about 1.0-1.5 cm. S. 47 filter is more convenient for this colorimetry.

31. Biochemical studies on the root-nodules of leguminous plants. Katura TUZIMURA (Journ. Sci. Soil and Manure, Japan. **21**, 111, **21**, 181, **21**, 283, 1951; Journ. Agr. Chem. Soc. Japan. **24**, 97, 1950; **24**, 266, 1951.)

The respiration of the root-nodules of leguminous plants, detouched from roots was studied by WARBURG's mannometric technique, comparing with root-nodule bacteria, separated from nodules or cultured artificially.

The rate of respiration of the nodules decreased in the generative stage of growth. The rate of respiration of nodules and roots was not markedly different, though the respiration quotient of the former was in the average 1.06 and that of the latter 0.89 as for soybean plant.

The respiration of the nodules decreased with decreasing partial pressure of oxygen and increased somewhat in pure oxygen than in air; about half in the atmosphere of 5% oxygen in nitrogen. But the rate of respiration of the bacteria centrifuged from nodules did not decrease in that condition.

The concentration of KCN at the half inhibition of respiration was about 3×10^{-4} mol for centrifuged bacteria from soybean and vetch nodules, and 5×10^{-5} mol for pea bacteria from the laboratory culture. For soybean nodules 10^{-2} mol was needed for half inhibition, due to probable inhibition of KCN penetration into the interior of the nodules.

CO inhibited the respiration of artificially cultured nodule-bacteria about half or more in the atmosphere of 95% CO and 5% O_2, whereas the centrifuged bacteria from nodules were innert to CO even in that concentration. The CO-inhibition of respiration of detouched soybean and vetch nodules was on average 23-25% in above concentration of CO. The extent of inhibition was too small to be expected from the equilibrium constant of the hemoprotein, $K = (HbCO)(PO_2)/(HbO_2)(PCO) \fallingdotseq 37$ reported by KEILIN and WANG. So that the participation of hemoprotein to the respiration of the nodules was not clearly demonstrated, though it is very probable.

The root-nodules were found to be extremely rich in lactoflavin content as compared with other parts of the plants. The average content was 14.6 mg% in dry

matter (3.6 mg% in fresh tissue) for soybean nodules.

By careful preparation of the material, the lactoflavin was detectable both in cell extract (mixture of protoplasma and cell sap) and bacteria. But most of the lactoflavin in the bacteria easily disappeared on extraction with water. The most part of the lactoflavin in the nodules existed in free state, flavinnucleotides could not be determined in cell extract of the nodules.

The lactoflavin seems to explain, at least in part, above phenomenon on the CO-inhibition of respiration of nodules.

32. The cross innoculation of the nodule bacteria of soybean. Takao MATSUDAIRA and Tatsuo OKABE (Journ. Sci. Soil and Manure, Japan. **21**, 313, 1951.)

It is important problem to solve the relations to the nodule formation between the strains of root nodule bacteria and the varieties of host plants. The author has examined the nodule formation between 6 strains of *Rhizobium japonicum* and 30 varieties of soybean.

In this experiment following results were obtained: There were clear differences of nodule formation between the strains of *Rhizobium japonicum* and varieties of soybean. All strains of *Phizobium japonicum* can not form the donules on few variaties of soybean plant roots, and the variety of soybean which did not form nodules had the specificity to the strain of *Rhizobium japonicum.*

33. Studies on the miscibility of fused magnesium phosphate and ammonium sulfate. I. Masao NAKAGAWA and Akira KITAMOTO (Bull. Fertil. Res. Insti. 31, 1950.)

Mixed dressing of ammonium sulfate and fused magnesium phosphate, a new basic fertilizer, will be favorable for soil conservation in our country, where the former is used heavily year after year and acid soil extends over large area.

Nitrogen loss of the mixtures laid open in various conditions in reference to our climate was determined. Mixtures made with carbonate lime or Thomas phosphate were also examined for comparison.

The results are as follows:

(1) The presence of a little moisture, even at a low temperature, causes marked nitrogen loss with Thomas phosphate very quickly. With fused phosphate and carbonate lime, such is not the case; and the former is more stable, probably for its formation of colloidal silicate, than the latter.

(2) In practice, the dry mixture of fused phosphate may be laid without any nitrogen loss, so long as its ammonium sulfate does not absorb moisture. If the mixture is dressed within a few days after mixing, ammonium salfate containing some moisture may also be used its material without serious loss of nitrogen.

(3) Commercial production of the mixed fertilizer is hopeful by the use of a moisture-proof package.

34. Studies on the enzymic formation and degradation of starch. III. Dry preparation of potato phosphorylase. Bunji MARUO (Journ. Agr. Chem. Soc. Japan. 23, 115, 120, 1949; **23**, 271-4, 1950)

A method applied for the dry preparation of potato phosphorylase consists of 1 volume of phosphorylase solution adding to 2 volumes of dioxane, centrifuging the precipitate, washing with dioxane and ether and drying in a vacuum desicator. Phosphorylase activity in this preparation is confirmed by (a) the iodine color test of synthesized starch, (b) the formation of inorganic phosphate from glucose-1-

phosphate, (c) the effect of starch on the rate of liberation of inorganic phosphate from glucose-1-phosphate, and (d) the formation of glucose-1-phosphate from starch and inorganic phosphate. This dry preparation is stable and keeps its activity for more than 2 years at room temperature.

VI. The distribution of phosphorylase, phosphatase, and β-amylase in plants (1). Michinori NAKAMURA, Kyoji YAMAZAKI and Bunji MARUO (Ibid. **24**, 197-201, 1951.)

The distribution of phosphorylase, phosphatase, and β-amylase in the leguminous seeds and root vegetables was studied. The methods of preparing enzyme solutions and methods of determining the activities of the above 3 enzymes are described. High phosphorylase activities are found in the leguminous seeds except soybean and pea. Sweet potato and soybean are high in phosphatase activities, and sweet potato, soybean, taro and kuwai are high in β-amylase activity. In view of the above results, the determination of phosphorylase activities was examined in the presence of high β-amylase activity. It was found that β-amylase interfered with the determination of phosphorylase activity. The necessity is emphasized to reexamine the results of phosphorylase determinations in samples with high β-amylase activities.

V. The distribution of phosphorylase, phosphatase, and β-amylase in plants. (2) The detection of phosphorylase activity in the presence of β-amylase. Michinori NAKAMURA and Bunji MARUO (Ibid. **24**, 299-302, 1951.)

Phosphorylase activity can not be detected in the presence of a large amount β-amylase. However, phosphorylase activity may be detected quantitatively by using appropriate amounts of mercuric compounds to inhibit the β-amylase activity. It was ascertained by means of the above procedure that phosphorylase was rather active in sweet potatoes.

VI. The distribution of pohsphorylase, phosphatase, and β-amylase in plants. (3) Mechanism of the inhibition of phosphorylase activity by β-amylase. Michinori NAKAMURA (Ibid. **24**, 299-302, 1951.)

Mechanism of the inhibition of phosphorylase activity by β-amylase, as in sweet potato or barley extract, was found to be due to the destruction of the added soluble starch as an activator by the action of β-amylase. To demonstrate directly the presence of phosphorylase in the sweet potato extract, phosphorylase in the sweet potato was purified by means of ammonium sulfate, and a preparation with high phosphorylase but with low β-amylase activities was obtained, with which the presence of phosphorylase in this extract was finally established.

VII. Amylosynthease and amyloglucosidase. Bunji MARUO and Tsuneo KOBAYASHI (Ibid. **24**, 309-13, 1951.)

Relationship between the α-glucosidase (amyloglucosidase) of MEYER (cf. Helv. Chim. Acta **24**, 1400, 1941) and amylosynthease (cf. Journ. Agr. Chem. Soc. Japan. **23**, 115, 120, 1949) was discussed. These 2 enzymes are very similar in the mode of action on the limit dextrin. Reaction products from the limit dextrin and from the glutinous rice starch produced by these enzymes were tested by SCHOCH'S butanol precipitation method, and they were proved to be the amylose-type polysaccharides. It is suggested that these 2 enzymes are identical and that their action consists in the breakdown of the branching points of α-glucosidic chains. Actions of amylosynthease upon the various polysaccharides of the starch-series were also discussed.

VIII. The enzymic transformation of amylopectin into amylose. Bunji MARUO, Tsuneo KOBAYASHI, Yutaka TSUKANO and Nobuhiro YAMADA (Ibid. **24,** 347–9, 1951.)

The transformation of glutinous rice starch and potato amylopectin into amylose by the action of amylosynthease was established by using the potentiometric iodine titration method by BATES, FRENCH, and RUNDLE (cf. Journ. Amer. Chem. Soc. **65,** 142, 1943). The yields of amylose from the amylopectin-type polysaccharides, as calculated from the titration curves, are approximately as great as 75% of the substrate. This is in support of the mode of action of this enzyme previously suggested by the authors (cf. Journ. Agr. Chem. Soc. Japan. **23,** 115, 120, 1949).

35. Colorimetric determination of phosphorus. Michinori NAKAMURA (Journ. Agr. Chem. Soc. Japan. **24,** 1-5, 1950.)

In the colorimetric determination of phosphorus by ALLEM (cf. Biochem. Journ. **34,** 858, 1940), sulfuric acid was used in place of perchloric acid with satisfactory results. Concentrations and dosages of reagents and other experimental conditions were examined in detail and slight modifications were made.

36. Studies on the inhibition of enzymes. I. The inhibition of potato phosphorylase by sulfonamide derivatives. Michinori NAKAMURA (Journ. Agr. Chem. Soc. Japan. **24,** 5-8, 1950.)

The inhibitory action of sulfonamide derivatives on potato phosphorylase was studied. Derivatives with N-containing heterocycles showed marked inhibitory effect on the enzyme action, while those without heterocycles had little effect. p-Aminobenzoic acid and thiamine had the antagonistic actions on the above mentioned inhibition. 4,4'-Diaminodiphenylsulfone inhibited the enzyme action, but little antagonistic action was found in this case with p-aminobenzoic acid.

37. Enzymic scission of the branch links in amylopectin. Bunji MARUO and Tsuneo KOBAYASHI (Nature **167,** 606-7, 1951; cf. Journ. Agr. Chem. Soc. Japan, **23,** 115, 120, 1949; **24,** 309, 347, 1951.)

The enzymic action of the so-called amylosynthease is not affected by the presence or absence of inorganic phosphate. This enzyme acts on the β-amylase-limit dextrin, allowing a further degradation of the reaction product by the β-amylase. It acts on the polysaccharides with ramified structure (the amylopectin type) and not on those of the amylose type. No hydrolytic action is observed on the dextran produced by *Leuconostoc mesenteroides*. It is concluded that this enzyme attacks the points of branching in the glucosidic chains (α-1, 6-linkage) to produce amylose-type substances, and a new name "isoamylase" is proposed for this enzyme. The possible identity of the "de-branching" enzyme (R-enzyme) (cf. HOBSON et al., Biochem. Journ. **47,** XXXIX, 1950) with this isoamylase is stated.

38. The "acid-labile" phosphate compounds in higher plants. Takao ÔMURA (Journ. Agr. Chem. Soc. Japan. **24,** 371-6, 1951.)

The phosphate compounds containing easily acid-hydrolyzable phosphate groups were examined in a variety of higher plants. Negative results were obtained except soybean cotyledons. This compound in the soybean cotyledons was purified according to the method of DOUNCE et al. (cf. Journ. Biol. Chem. **174,** 361, 1948) of the isolation of adenosinetriphosphate from the rabbit muscle. The analytical data and the absorption in the ultraviolet suggested a nucleotide nature of this compound, the

identity of which is not yet complete owing to the low degree of purification thus far obtained.

39. Studies on the so-called amylosynthease. Bunji MARUO and Tsuneo KOBAYASHI (Chem. Res. 7, 47-69, 1950.)

A historical review on the so-called amylosynthease is given, in which the emphasis is laid upon the works of these authors, and a new theory on the mode of action of this enzyme is proposed as well.

40. Biochemical studies on vitamin B_{12}. I-II. Yoshikazu SAHASHI, Masayuki MIKATA and Heiichi SAKAI (Bull. Chem. Soc. Japan. 23, 247-9, 1950; Proc. Committ. Res. Vit. B. 40, 1, 1950.)

Part I. A simple method of preparation of vitamin B_{12} concentrate from cow liver is described. The test of its physiological potency by the bone marrow culture method, the results of which are described, revealed satisfactory responses in red blood cell, white blood cell and reticulocyte and proved to be free from folic acid by the negative antagonistic activity against aminopterin. Furthermore, clinical tests, carried out by Dr. K. INOUE, showed haematopoietic responses to the anemia patients without any shocks.

From these results, 1cc. of the vitamin B_{12} concentrate was accurately estimated to correspond to 10μg of pure vitamin B_{12} (MERCK'S "Cobione").

Part II. 5, 6-Dimethylbenzimidazole (A) was chemically synthesized. In the first experiment, addition of (A) to a fresh chick liver paste and incubation of this mixture at 37°C for 60 hours caused an increase in vitamin B_{12} content over that of the control by 20-25%.

In the second experiment, addition of 1 mg of (A) to 50 cc. of DULANEY'S medium, inoculated with *Streptomyces* X-28 and incubation for 6 days caused an increase in the vitamin B_{12} content over that of the control by 100-150%, while the addition of $CoCl_2$, 0.06 mg per 50 cc. of DULANEY'S medium, had little effect. Vitamin B_{12} content was assayed microbiologically using *Lactobacillus lactis* DORNER, which did not show growth response to pure (A).

41. Studies on the chromatography of vitamin B_{12}. Yoshikazu SAHASHI, Masayuki MIKATA and Heiichi SAKAI (Proc. Committ. Res. Vit B. 42, 29, 1950.)

Paper chromatography of vitamin B_{12} was studied by ROCKLAND and DUNN'S method with Japanese research materials and the Rf value was determined by bioautography with *Lactobacillus lactis* DORNER.

42. Biochemical studies on vitamin B_{12}. III. Yoshikazu SAHASHI, Masayuki MIKATA and Heiichi SAKAI (Ibid. 44, 25, 1951.)

Further studies on biochemical synthesis of vitamin B_{12} from 5, 6-dimethylbenzimidazole were carried out with chick liver paste by the addition of P_{32} labeled phosphate. From the results, tested by microbial assay (L.L.D.) and radioautography, no radioactivity in the vitamin B_{12} concentrate was observed.

43. Biochemical studies on vitamin B_{12}. IV. Yoshikazu SAHASHI and Kiichi IWAMOTO (Ibid. 45, 31, 1951.)

An endemic disease known "Kumazu" disease in Shiga prefecture was studied from the interest of vitamin B_{12} metabolic observation.

(1) At first, the distribution of *Actinomyces* in cow manure and their powers of vitamin B_{12} production was studied. No active *Actinomyces* was found in feces of

cow suffering from "Kuwazu" disease, but the microrganism was isolated from normal cow in Japan.

(2) On the other hand, growth inhibiting ion of SiF_6'' was detected from the water in this district, and moreover, a similar symptom to human amemia was observed in animals suffering from the disease.

From these findings, the authors probably assumed that an etiolagy of "Kuwazu" disease may be the deficiency of the vitamin B_{12}.

44. Biochemical studies on vitamin B_{12}. V. Yoshikazu SAHASHI, Masayuki MIKATA, Heiichi SAKAI and Kiichi IWAMOTO (Ibid. **46**, 22, 1951.)

(1) The most convenient estimation methods of vitamin B_{12} in Japanese laboratory were studied: Recording Spectorophotometric method, BECKMAN Quarz Spectorophotometric method, *Lactobacillus leichmannii assay*, and so forth.

(2) Toxic activity of SiF_6'' against *Actinomyces* was studied and observed that the fatal amount may be 1.2-2.0 mg of SiF_6'' in 10 cc. of the culture medium.

45. The bioassay of the fat-soluble vitamins. II. Biological determination of vitamin A in the whale-liver oils. Akihiko NAKAYAMA (Journ. Sci. Res. Inst. **44**, 162-70, 1950.)

The biological vitamin A potency in sperm whale-liver oil and mixed whale-liver oil (a mixture of fin whale- and blue whale-liver oil) were both inferior to that of the fish-liver oil. Blue whale-liver oil and its molecular distillate corresponded to 55.6 and 65.7% respectively of the value estimated physico-chemically with a BECKMAN spectrophotometer. No difference was observed between the two groups of animals fed on whale-liver oil and fish-liver oil when the oils in the livers and feces of these animals were extracted with soybean oil and examined by the absorption at 328 mμ (vitamin A) and 290 mμ (kitol). There was no significant difference either between these two groups in the death rate and in the severeness in the eye diseases.

46. The biological potency of vitamin A in the whale-liver oil and its molecular distillates. Yoshikazu SAHASHI, Akihiko NAKAYAMA, Shuichi HIRAO and Toyosuke KINUMAKI (Bull. Jap. Soc. Sci. Fish. **16**, 46-52, 1950.)

47. On the reduction of 1-bromosinomeneine. Kakuji GOTO, Tatsuo ARAI and Tetsurô KÔNO (Bull. Chem. Soc. Japan. **23**, 17, 1950.)

Reduction of 1-bromosinomeneine with Al isopropylate or PtO_2+H_2 in pyridine gives a base, 1-bromosinomeneinealcohol, m.p. 171°, which is insoluble in 2% NaOH, gives no $FeCl_3$ test in MeOH, and does not react with diazomethane. It gives 1-bromo-3, 7-dimethoxy-4, 6-diacetoxyphenanthrene on acetolysis, and gives 1-bromosinomeneine on oxidation with CrO_3 or with $KMnO_4$. Monobenzoyl derivative, m.p. 194.5°. Solution of this substance in 2% HCl at room temperature and precipitation with Na_2CO_3 gives 1-bromosinomeninone in 64% yield. The mechanism of this rearrangement is discussed.

48. Studies on the proteolytic enzymes in plant. Part 1. The Viscosimetric determination of Papain Activity and the Action of Cation Exchangeable Base on the Papain. Yoshihiko MATSUYAMA, Kensuke SHIMURA and Masami SOEJIMA (Journ. Agr. Chem. Soc. Jap. **24**, 222-226, 1951.)

By the viscosimetric determination it was found the proteolytic activity of papain inhibited by heavy metal ions such as Hg^{++}, Cu^{++} could be recovered by cation exchangeable base (C.E.B.), while C.E.B. alone has no effect on the activity of natural

papain. This fact shows that the activation of natural papain by cystein or HCN is not due to the removal of heavy metal ions from the enzyme molecule.

49. Studies on the nutritive value of leaves and stems. I. Nutritive value of wasuregusa (*Hemerocallis fulva L.* var. Kwanso REGEL.) Makoto KANDATSU and Aya NAKANO (Journ. Jap. Soc. Food and Nutrition **2**, 207-208, 1950.)

II. Nutritive value of pine needles. Makoto KANDATSU, Shinichi HARUYAMA and Masaaki OGASAWARA (Tōhoku Nogyo **4**, 75-78, 1950.)

50. Studies on microbiological assay for riboflavin with lactic acid bacteria. Part 1. The relationship between the growth of *Lactobacillus acidophilus* and the composition of medium. Ichiro YOSHIHARA (Journ. Agr. Chem. Soc. Japan **23**, 305-309, 326-329, 1950.)

Titrimetric responses of 11 species of lactic acid bacteria to riboflavin were tested in relation to the microbiogical assay. The medium and the procedure reported by E.E. SNELL in 1939 were used. The results showed that *Lactobacillus acidophilus* is the most suitable bacteria among those tested. But for some kind of samples microbiological assay with this organism was unsuccessful. Fundamental experiments were carried out to solve this problem.

In these experiments to determine quantitatively the bacterial response to added riboflavin, the turbidity produced by the growth of the organism was measured using PLUFRICH-photometer. The inoculated assay tubes were incubated at 37° for 24 hours. After the measurement of turbidity the contents of the assay tubes were titrated with 0.1 N sodium hydroxide. The results are summarized as follows:

(1) The growth of *Lactobacillus acidophilus* is not affected by the temperature change of 37°±1°, but at 37°-38° the acid production is apparentlty more rapid than at 36°-37°.

(2) When glucose and photolyzed peptone are added simultaneously to the medium reported by E. E. SNELL, the growth and acid production of *Lactobacillus acidophilus* increase extremely without added riboflavin.

(3) Without the simultaneous addition of glucose and poptone, addition of one or more components can not give rise to such increase between 0.03 and 0.11 microgram of riboflavin per 10 ml.

(4) On standing after autoclaving, the medium may become defective. The possibility of the microbiological assay for riboflavin with *Lactobacillus acidophilus* is shown, but on application to various materials, it is necessary to notice that the growth and acid production of *Lactobacillus acidophilus* can be affected not only by the amount of riboflavin, but also by other materials in the solution tested.

51. Studies on the manufacture of milk casein for glue materials. Rinjiro SASAKI, Tomokichi TSUGO and Takeo NAKANISHI (Jap. Soc. Promot. Sci. 47-60, 1951.)

The manufacturing methods of milk casein were modified as follows:

(1) Utilizing acid whey obtained by lactic acid fermentation as a substitute of hydrochloric acid for a precipitant, (2) removing ash by washing with hydrochloric acid from rennet casein. The products obtained by these methods were proved to be not inferior in the quality as glue material for wood, but rather superior in the waterproofing property as compared with ordinary hydrochloric acid casein.

52. Studies on the manufacture of milk foods utilizing whey. Rinjiro SASAKI and Tomokichi TUSGO (Jap. Soc. Prompt. Sci. 63-72, 1951.)

The methods for utilizing lactic acid- and rennet whey obtained by manufacturing milk casein (previous studies) as food were investigated, and it was able to accomplish the purpose in which the reaction of the whey was adjusted by adding lime, protein and fat supplemented by mixing soybean milk and then the mixture was condensed or dried.

53. A simple volumetric method for determining casein. Rinjiro SASAKI (Jap. Soc. Promot. Sci. 61-62, 1951.)

A simple volumetric method for determining casein for glue material was proposed. This method is consisted of modified formal titration procedure of WALKER's method.

54. The content of urea in the milk when urea was fed to dairy cows. Rinjiro SASAKI and Tomokichi TSUGO (Animal Husbandry **5**, 531-532, 1950.)

When urea was fed at the rate of 3% of concentrate mixture in practical experiments utilizing urea for the dairy cows ration, it was found that the injection of urea had no measurable effect on the content of urea in the milk.

55. Studies on the preparation of rennet. I. Experiments on the preparation of rennet extract by the extraction with sodium chloride solution. II. Experiments on the preparation of rennet extract by the extraction with salt solutions other than sodium chloride. III. Experiments on the preparation of rennet powder. Tomokichi TSUGO (Sci. Animal Products **1-2**, 147-154, 155-159, 159-164, 1951.)

These studies were made with the object of establishing comparatively simple, efficient and practical methods of manufacturing rennet extract and rennet powder from the fourth stomach of calves.

(1) By the method of extracting with sodium chloride solution, it was found that (a) the suitable concentration of sodium chloride was 5%, (b) the most superior preservative was alcohol (10%), and the good keeping quality of rennet extract was attained when its reaction was controlled between pH 5 and 6.

(2) By the method of extracting with various salt solutions other than sodium chloride, solution, it was found that calcium chloride was far better than sodium chloride, and the proper practical concentration to be used was 10% solution, and as the preservatives to be added, alcohol was the most suitable as the same with sodium chloride extraction.

(3) A method of preparing rennet powder was established. It was comparatively simple and efficient, it consisted of extracting with 0.2% hydrochloric acid, 2/3 saturation with sodium chloride after pH of the extract was adjusted to 4.5, washing the precipitate with saturated sodium chloride solution and vacuum drying.

56. On the chemical properties of soy bean protein for glue materials. Rinjiro SASAKI (Jap. Soc. Promot. Sci. 104-109, 1951.)

Comparative studies on seven commercial soybean protein products for glue materials and on the chemical composition, the form of nitrogen compounds, solubility and viscosity were made.

57. Edibility of fish oil, deodorized by the process of aeration. Rinjiro SASAKI Yoshiyuki OTAKE and Motoyoshi MIYAZAKI (Journ. Jap. Soc. Food and Nutrition **3**, 139-144, 1951.)

Fish oil is an important source of calory in Japanese food. But it has an unpleasant fishy order and is not usually used for food. To remove the bad oder such

a method of deodorization was found as blowing air in the fish oil with sulfuric acid added and heated. Of course, the added sulfuric acid should be removed afterward. This deodorized fish oil could be used as an edible oil and digested and utilized as calory in animal body.

Contents of the study are as follows: (1) sample material is oil of fat fish, (2) physical and chemical change of fish oil by the invented process of aeration, (3) experiment of artificial digestion of this deodorized fish oil by pancreatic lipase, (4) relations ebtween oxydation and polymerization of fish oil and its digestibility, and (5) nutritive value and source of calory of the deodorized oil in animal body.

58. Studies on the cultivation of *Lespedeza Michx.* (*Japanese "Hagi" plant*). Fusao KUNORI and Rinjiro SASAKI (Animal Husbandry **4**, 201-204, 1950.)

"Hagi" plant is an important wild grass as fodder in Japan. 8 famous species experimented for cultivation were as follows:

(1) *L. bicolor* TURCZ., *L. bicolor* TURCZ. var. *japonica* NAKAI, *L. cyrtobatrya* MIQ., *L. nikkoensis* NAKAI, *L. Thunbergii* NAKAI, *L. Buergeri* MIQ., *L. tomentosa* SIEB. and *L. sericea* MIQ., (2) seed and seed time, (3) germination and germinative ability, (4) growth of grass and (5) yield of fodder.

59. Studies on the utilization of enzymes in the internal organs of fish. Part 1. On the enzyme activity of internal organs. Part 2. On the separation of protease from the internal organs of fish. Rinjiro SASAKI and Satoshi ODAGIRI (Journ. Agr. Chem. Soc. Japan **24**, 350-354, 1951.)

The activities of pepsin-, trypsin-, lipase- and amylase-like enzymes were examined on various sorts of fishes. The results show that the internal organs of mackerel, bonito and sardine are the most suitable as raw materials of trypsin among fishes used in these experiments.

Enzyme powder is prepared from internal organs of fish as follows: from fish pyloric coeca containing much protease crushed with sand, clear extract is obtained by filtration or centrifugation. After Japanese acid clay is added to this solution, clay is separated by centrifugal separation and dried in a desiccator The enzyme can be eluted from this prepared clay by a slightly alkalined buffer solution.

60. Studies on the relation of formol reaction of fish meat with its freshness. (Preliminary report). Rinjiro SASAKI and Masao FUJIMAKI (Rep. Jap. Canners Ass. **2**, 1-6, 1950.)

When neutralized formalin solution was added to aqueous extract of tunny meat, it was observed that the solution was clear, turbid, and then coagulative as the freshness of the meat decreased. Coagulative precipitation in formal reaction of fish meat was observed at the beginning point of putrefaction, nearly parallel with the increase in pH value and volatile basic nitrogen.

61. Studies on fermentation products of fish protein. Rinjiro SASAKI and Masao FUJIMAKI (Rep. Jap. Canners Ass. **2**, 32-34, 1950.)

62. Studies on the turbid matters in the canned mandarin oranges. Part 2. Masao, FUJIKAMI Satoshi ODAGIRI and Akira FUJIMOTO (Rep. Jap. Canners Ass. **2**, 54-57, 1950)

Quantitative analytical methods of hesperidin were described in the previous report. On the juice of canned mandarin oranges manufactured by several different procedures, relation between turbidity and hesperidin contents, and changes of the latter in manufacturing process were studied.

63. Studies on vitamin C enriched canned foods. Part 1. Masao FUJIMAKI and Satoshi ODAGIRI (Journ. Jap. Soc. Food and Nutrition **4**, 25, 1951.)

To enrich vitamin C content in canned products, the waste liquid from refining process of vitamin C crystals was added to canned mandarin oranges and apple jams. After their preservation at room temperature for one year, vitamin C retention showed good results in both products. In this case, foreign taste from the waste liquid was felt slightly, but it was found its elimination was possible by passing ion exchange resins.

64. The biochemistry of bakanae fungus. Part 21-22. Teijiro YABUTA, Yusuke SUMIKI, Kazuo FUKUNAGA and Masahiko HORIUCHI (Journ. Agr. Chem. Soc. Japan **24**, 395-397, 1951.)

Part 21. The reaction of ultra-violet ray against the physiological activity of gibberellin was determined by measuring the heights of the stems of young rice seedlings which were grown from the seeds treated with gibberellin.

Although it could not be shown so quantitatively, by irradiation of ultra-violet ray during 60 minutes, the physiological activity of gibberellin disappeared quietly in the 0.0002% solution and decreased to about an half in the 0.0004% solution.

Part 22. Rice seedlings were cultured by treating with or without gibberellin and general components of these seedlings were analyzed quantitatively in comparison with the control. The stem is taller and the root is shorter than those of the controlled but there was not so great a difference between total weights. It could not be found either so great a difference between moisture, ash and total nitrogen contents. But the quantity of total carbohydrated was found to be smaller, although distinction was not so smaller as to be expected from their external appearance with much thinner and lighter green color.

65. Studies on the strengthening of silkfibres. Part II. Yusuke SUMIKI, and Zenji NAGASHIMA (Journ. Agr. Chem. Soc. Japan **24**, 42-43, 1950.)

Silk fibres coated by treating them with linolenic, oleic, and palmitic acids in the same method as that reported in Part I of this series, and their properties such as intensity, ductility under dry or wet condition, absorption of moisture and fixation of sericine were examined.

66. On the antibacterial activities of coumarin derivatives. Saburo TAMURA, Yoshio ISHII and Tsuneo KADA (Journ. Antibiotics **3**, 601-602, 1950.)

About 30 coumarin derivatives were prepared and their antibacterial activities were examined. Among them dicoumarol and its bromide, 3-acetyl-4-brome coumarin were most active on bacteria belonging to the Gram-positive and Gram-negative types. 6, 8, 6′, 8′,-Tetrabromodicoumarol inhibited completely the growth of *St. aureus* (TERAJIMA) at the dilution of 1: 40,000, and the growth of *E.coli* and *B. Subtilis* at the dilution of 1: 80,000 respectively. These coumarin derivatives were inactivated by thiol compounds such as cysteine and thioglycolate. Some of them were treated with thiol compounds at room temperature in the presence of anhydrous K_2CO_3. From 3-acetyl coumarin and thiophenol colorless needles, m.p. 58-59°, and from 3-acetyl-4-brome coumarin and thiophenol pale yellow needles, m.p. 56-57° were obtained respectively. It was assumed that their antibacterial activities probably due to their reaction with biologically essential thiol groups in the bacterial cells.

67. Studies on the purification of penicillin. Part III. Several amine salts of penicillin G. Takuro SADO, Hiroshi YONEHARA and Yusuke SUMIKI (Journ. Antibiotics **3**, 801-802, 1950.)

About twenty tertiary amines were prepared and their salts with penicillin G were examined. Some were obtained as crystals, some were separated as oily substances and some yielded no precipitation. Among them, the trimethylamine salt of penicillin G obtained in crystal, prism m.p. 107°C (dec.), has the potency of 1431 u/mg. Yielded 75% of the theory. And also its physical properties were described comparing with the crystal of triethylamine, N-ethylpiperidine-, and procaine-penicillin G salts.

68. Studies on the purification of streptomycin. Part I. Purification by precipitating reagents. Hiroshi YONEHARA, Minoru TANAKA and Yusuke SUMIKI (Journ. Antibiotics **4-A**, 12-3, 1951.)

For the isolation of streptomycin from concentrated broth 11 kinds of precipitating agents were examined. As the result, streptomycin was precipitated by phosphotungatic acid, silicatungatic acid, potassium laurylsulfonate, sodium laurylsulfonate, sodium laurylsulfurate, flavianic acid, lauric acid, picric acid and tannic acid, but not by styphinic acid, picrolonic acid and ammonium rhodanilate.

These precipitates were converted into HCl-salt or H_2SO_4-salt of streptomycin, and their yields were examined respectively.

As it is cleared that the phosphotungatic acid is the best precipitating reagent of them, the authors have applied this to the concentrated broth and obtained a pale yellowish powder of 325 u/mg. of streptomycin-H_2SO_4 salt, 61.6% with yield.

Part II. Purification with cation exchange resin. Hiroshi YONEHARA, Teruhiko TOYAMA and Yusuke SUMIKI (Journ. Antibiotics **4-A**, 14-9, 1950.)

The conditions of cation exchange resin in the purification of streptomycin were examined. The resin used was "Daiya Ion K", phenol-sulfonic acid type made by Mitsubishi Kasei Co. The resin was activated by pretreating with 1N HCl before adsorption.

In the static system, the more streptomycin was adsorbed in higher PH, since then streptomycin was adsorbed at pH 8.0. In the current system, streptomycin was more adsorbed than static process in lower velocity, and the value of the maximum adsorption was ca. 150,000 units per one gr. of resin at apace velocity (S.V.) 10cc/cc/hr., linear velocity (L.V.) 51/cc/cm^2.

Streptomycin thus adsorbed was perfectly eluted by 1N K_2SO_4 at different velocities, and in the case of lower velocity streptomycin could be concentrated. As the eluting salt, K_2SO_4, KC1, KH_2PO_4 and K_2HPO_4 gave satisfactory results, and HCl the most applicable. The concentration of salts for elution must be high, and when concentration of K_2SO_4 were less than 0.1 N and S.V. was 5cc/cc/hr. Streptomycin was not elued. Che elution of streptomycin adsorbed from culture broth was somewhat worse than that from pure streptomycin.

Founded on the fundamental experiments mentioned above, experiments were carried out with tank culture broth. 15 L of filtrated broth (175 u/cc) were flowed into the 50 gr. resin layer at S.V. 10cc/cc/hr., L.V. 400cc/cm^2 hr., and was eluted by 1NKCl at S.V. 1cc/cc/hr., L.V. 40cc/cm^2/hr., the adsorption and elution were worse than above described experiments on account of too high L.V. Then 180 cc of eluted

solution (1,360 u/cc) taken from high potency fractions were dried up in vacuo, and crude streptomycin HCl salt thus obtained was dissolved with methanol containing hydrochloric acid, and was precipitated by 10 volumes of absolute acetone. Then 426 mg of streptomycin-HCl (563 u/mg) was obtained. By repeating dissolution and precipitation by absolute ether, streptomycin-HCl with potency of 721 u/mg was obtained as yellowish white powder.

Part III. Purification by solvent extraction method. Minoru TANAKA, Hiroshi YONEHARA, Takuro SADO and Yusuke SUMIKI (Journ. Antibiotics **4-A**, 20-22, 1951.)

The contents of carrier and the volume of solvent were studied. With various taining carrier were studied. Solvents used were n-butyl alcohol, iso-amyl alcohol, methylacetate and butylacetate. As carrier, lauric acid, potassiumlaurylsulfonate and sodiumlaurysulfurate were used mainly. As model experiments, solvent containing 5% of lauric acid was mixed with the distilled water in which dissolved streptomycintrihydrochloride, shaked, and the pH of aqueous solution was adjusted to various values with hydrochloric acid or sodiumhydroxide. In the case of n-butanol, streptomycin was extracted into salvent remarkably at the extent of pH 6.4-7.0, especially at about 6.5 almost perfectly, and under the pH of 4.5 streptomycin remained in aqueous solution, so that, streptomycin was reextracted perfectly with acidic water at the pH 2.0 from n-butanol containing streptomycin. In the case of iso-amyl alcohol at pH 6.5-7.5 almost perfectly was extracted, but at under pH 5.5 was not extracted, and reextracted with distilled water perfectly at the pH 2.0. In the case of methylacetate and butylacetate, distribution coefficients were all less than 1.13 regardless to pH.

When 5% of potassium laurylsulfonate, or sodiumlauryl sulfurate were used as carrier in n-butanol, distribution coefficients were 1.8-10.8.

The contents of carrier and the volume of solvent were studied. With various contents of lauric acid n-butanol ranging from 20% to 0.5%, there was no difference of coefficients between the concentrations of carrier. The necessary quantity of solvent to extract streptomycin from aqueous solution, and the necessary quantity of acidic water to resolve from solvent to water again at lower pH were studied, and it was proved that 1/5 volume of solvent or acidic water in each case was enough, without any loss of streptomycin.

Thus streptomycintrihydrochloride was obtained as powder from broth by this solvent extraction method with high yield.

69. A study on the durability of the "Kuro-Koji" mold. Kin-ichiro SAKAGUCHI, Hiroshi IIZUKA and Tatsuro YAMAGUCHI (Journ. Agr. Chem. Soc. Japan **24** (7), 317, 1951.)

It is widely recognized that "Tane-Koji", or a starter for black Koji making, consisting chiefly not so well as those of yellow green *Aspergilli* or *Asp. oryzae* and *Asp. sojae.* The present research has been carried out to find resistant strains for preservation of "Tane-Koji" among "Kuro Koji" (black Asp.) molds.

About 14 years ago (1935), Dr. K. SAKAGUCHI collected 402 samples of "Kuro-Koji" or mouldly material for Awamori and Imo-Shō-chū making, of soils of the factories and of the fermenting mash, from the southern districts of Japan, and isolated from them about three hundreds different strains of black *Aspergilli* and classified them. From those samples which have been preserved in tin cans for these 14 years, the authors isolated the black *Aspergilli* and other molds in May, 1949.

(1) The isolated species, which have survived for so long a time, were *Asp. Usamii* (2 strains), *Asp. Saitoi* (180), *Asp. Saitoi* var. *Kagoshimaensis* (28) and *Asp. awamori* (40), while *Asp. Inuii, Asp. aureus,* and *Asp. Nakazawa* have not been found.

(2) The amylolytic powders and the rates of acid productivity of the newly isolated strains were compared with those which had practically been used in the above fermentation industries. And several strains belong to *Asp. Usamii* and *Asp. saitoi* var. *Kagoshimaensis* were found to be effective for the purpose.

70. Studies on black *Aspergilli.* Kin-ichiro SAKAGUCHI, Hiroshi IIZUKA and Senji YAMAZAKI (Journ. App. Mycology **3** [2] 53, **3** [3] 65, 1949, **3** [4] 97, **4** [1] 1, 1950.) and (Journ. Agr. Chem. Soc. Japan **24** [3], 138, 1951.)

Some members belonging to black *Aspergilli* have been widely used for manufacturing "Imo-Schōchū" or sweet potato distilled wine in the sourthern districts of Japan, such as in Kagoshima, Miyazaki, Hachijo and other Izu islands and Lūchū. Among these strains five species have hitherto been reported; i.e., *Asp. luchuensis* INUI, *Asp. batatae* SAITO, *Asp. awamori* NAKAZAWA and its varieties, *Asp. aureus* NAKAZAWA and its varieties and *Asp. miyakoensis* NAKAZAWA.

From April to July, 1935, the authors visited almost all brewers located in these districts above mentioned, and collected 435 samples from "Kuro-Koji" (moldly material) fermenting mash and soil of the factories, and isolated from them about three hundreds different strains of black *Aspergilli.*

All of the isolated strains are quite different from ordinary *Asp. niger* in the characteristics of the conidial wall surface, the former show somewhat rough appearance or even perfectly smooth, while, in the latter distinctly echinulate or with colored bars, as recognized by Ch. THOM.

The isolated strains, including 4 new species and 4 new varieties, along with the hitherto known species may be classified as in the following key.

A key for the classification of the "Kuro-Koji or Black-Koji" moulds. Number

1)	Conidial wall with coloured bars when mature .... *Asp. niger* group	
1)	Conidial wall smooth, rough or rarely echinulate .... "Kuro-Koji" mould group.... 2)	
2)	Colonies black .... 3)	
2)	Colonies with olive shades .... 7)	
2)	Colonies with brown shades .... 9)	
3)	Assimilate nitrites .... 4)	
3)	Do not assimilate nitrites .... 6)	
4)	1st sterigmata over 30 μ .... *Asp. batatae* SAITO	0)
4)	1st sterigmata 13-25μ .... 5)	
5)	Yellow pigment produced .... *Asp. Usamii* nov. sp.	4
5)	Yellow pigment not produced .... *Asp. Usamii* var. R-17 nov. var.	1
6)	1st sterigmata 15–23 μ, conidiophore 2–3 mm or larger .... *Asp. Saitoi* nov. sp.	33
6)	1st sterigmata up to 16μ, colonies somewhat mummy brown .... *Asp. Saitoi* var. R-16 nov. var.....	6
6)	1st sterigmata 10–13μ, conidiophore under 1.5 mm, conidial heads crowded .. *Asp. Saitoi* var. *Kagoshimaensis* nov. var.	6

7) Colonies with olive shades, assimilate nitrites .... 8)

8) Sterigmata mostly in double series but often mixed with single series in the same heads, 1st sterigmata 5 μ.. *Asp. Inuii* nov. sp. (Synonym *A. luchuensis* INUI?) 14

8) Sterigmata in double series ordinarily.. *Asp. Inuii* var. K-19 nov. var. 1

9) Colonies with brown shades ....10)

10) Assimilate nitrites ....*Asp. aureus* NAKAZAWA,
Asp. aureus var. *minor* NAKAZAWA, SHIMO et WATANABE
Asp. awamori fumeus NAKAZAWA, SHIMO et WATANABE
Asp. aureus f. R-2
.... 21

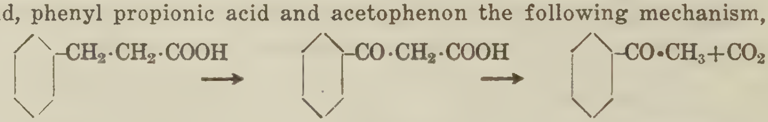
10) Do not assimilate nitrites ....11)

11) Yellow-orange pigment produced in mycelium, conidial heads not seen in ordinary colonies ....*Asp. Nakazawai* nov. sp. 15

11) Yellow-orange pigment not produced ....
Asp. awamori NAKAZAWA
Asp. awamori var. *minimus* NAKAZAWA, SHIMO, et WATANABE
Asp. awamori var. *piceus* NAKAZAWA, SHIMO et WATANABE
Asp. awamori var. *fuscus* NAKAZAWA, SHIMO et WATANABE
Asp. aureus var. *acidus* NAKAZAWA, SHIMO et WATANABE
Asp. aureus var. *murinus* NAKAZAWA, SHIMO et WATANABE
Asp. awamori f. R-5, R-9, H-2, and R-1
.... 71

71. On the metabolism of fatty acid by molds. Ginzo YAMAMOTO (Enz. Chem. Synposium, Japan **5**, 74-80, 1950.)

(1) The mold belonging to *Aspergillus* and *Penicillium* decomposes aromatic fatty acid, phenyl propionic acid and acetophenon the following mechanism,



Phenyl propionic acid Benzoyl acetic acid Actophenon

(2) When the mold is cultured in the media which is added by phenyl propionic acid, beta-decarboxylase which decarboxylates benzoyl acetic is produced as an adaptive enzyme.

(3) The intermediate mechanism of beta-oxidation is considered by the formation of the adaptive enzyme, and thus demonstrated that beta-hydroxy-phenylpropionic acid is not the intermediate substance in this process.

(4) The optimum conditions of the formation of the adaptive enzyme beta-decarboxylase are addition of phenylpropionic acid 0.1%, opt. temp. 25-30° and 3 days culture.

(5) Preparations of cell free enzyme extracted from the mycelium, and various properties of enzyme chemistry of the preparation was determined, and thus demonstrated as one new beta-carboxylase.

Opt.-pH; 5.8-6.0,
Opt.-temp. 28°C,
Inhibition occurs by heavy metal salts and KCN,
Km=0.0015.

72. Studies on bacteria isolated from putrified moromi-mash of Saké. Ōki NAKAYAMA and Hiroichi AKIYAMA (Journ. Soc. Brewing, Japan **46**, 72, 1951.)

The various bacteria were isolated from the putrefied moromi-mashes of Saké, of which the acid forming bacteria were studied.

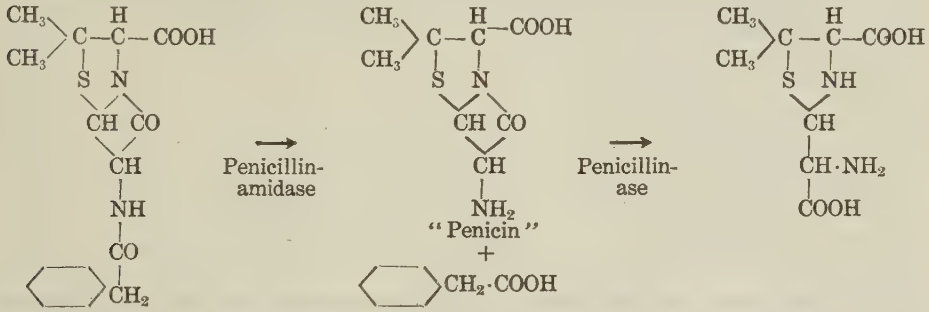
They belonged to lactic acid bacteria—*Lactb. fermentum* (39), *Lactb. brevis* (5), catalase+lactic bact. (6), *Leuconostoe mesenteroides* (2) and catalase+coccus (2). Also we found gluconobacter and acetogluconobacter.

There was no relation between the grade of putrefaction of mash and species of bacteria, but the number of bacteria in mash was important. Because bacteria above mentioned were found also in normal fermenting mashes, but very few in number.

73. A preliminary report on a new enzyme, "Penicillin-amidase". Kin-ichiro SAKAGUCHI and Sawao MURAO (Journ. Agr. Chem. Soc. Japan **23**, 411, 1950.)

The authors have found in the mycellium of *Penicillium chrysogenum* Q 176 a new enzyme "penicillin amidase" which splits penicillin G into its components, i.e., phenyl acetic acid and a residual portion of penicillin G, or "penicin".

The reaction catalyzed by the enzyme may be as follows:



Penicillin G Phenyl acetit acid "Penicic acid"

From the reaction mixture phenyl acetic acid and a substance which we presume "penicin" have been isolated, the latter substance being in the form of hygroscopic crystalline needles giving m.p. 158-159°C. This substance, which itself does not give ninhydrin reaction, develops an intense blue violet coloration by ninhydrin reagent after it was acted with penicillinase. By the use of the purified enzyme preparation obtained by fractional precipitation with acetone, it has been shown that the new enzyme is distinctly different from the proteolytic enzymes, asparaginase and hippuricase of the mold. The optimum activity ranges are at 35-38°C and pH 7.6-8.0.

74. Studies on the production of mold protease in the submerged culture. Part 1. Hideo SHIOTA and Kin-ichiro SAKAGUCHI (Journ. Agr. Chem. Soc. Japan **23**, 426, 1950.)

The purpose of this study is to utilize the mold protease by submerged culture process for making soya-sauce, soja-paste or acid hydrolysate of protein.

Six potent strains of *Asp. oryzae* were selected by the shaking culture method. Optimum composition and reaction of the medium for the production of the enzyme were determined.

17 strains belonging to *Bac. subtilis,* were tested, and the proteteolytic activities of the enzyme solution were the same or somewhat stronger than those of *Asp. oryzae*.

75. Studies on penicillinase. Sawao MURAO (Journ. Antibiotics **III-8**, 489, 1950.)

Sixty contaminant strains which produced penicillinase in the fermenter of penicillin industry were isolated, and the classification of these bacteria have been made. The conditions of the pencillinase production were examined by using the strain *Bacillus cereus* var. 1, which had been strongest penicillinase producer among the above contaminants. When the *Bac. cereus* was cultured mixed with *Pen. chrysogenum* Q 176 or when penicillin solution was added continuously to the culture medium during incubation period about twenty to fifty times more penicillinase was produced than when only *Bac. cereus* was cultured. Penicilloic acid was presumed to have the action of inhibitor to the penicillinase production. The author have succeed to isolate the crystalline, penicillinase from the supernant liquid of the centrifuged culture media of high penicillinase potency.

The properties of the crystalline enzymes are as follows:

Form	needles
Penicillinase activity	400,000 u./mg; 380,000 u./mg.
Mother liquid penicillinase activity	45 u./mg; 40 u./mg.
Yield culture solution	0.9 mg./L.; 0.3 mg./L.
Decomposition point	281°C.; 285°C.
Cl_2 ($AgNO_3$ test)	—
NH_3 (Nessler reagent)	+
Protein reaction	
Biuret	+
Millon	+
Xanthoprotein	+
Adamkwictz	—
Lieberman	—

76. The estimation of nutritive value of proteins by lactic acid bacteria. Gakuzo TAMURA, Toshinao TSUNODA, Jiro KIRIMURA, Kin-ichiro SAKAGUCHI and Kei ARIMA (Journ. Agr. Chem. Soc. Japan **24**, 422, 1951.)

The authors have studied the so called "lactic acid value" of various protein such as egg albumin, casein, gelatin, etc. using several lactic acid bacteria, as test organisms. The lactic acid values were measured according to ordinary bio-assay method with acid and pancreatin hydrolysates of the above proteins, the basal medium being free from amino acide, and expressed by maximum acid production and $\tan\theta$. ($\tan\theta = V/c$ of NaOH, C=% of protein). If they can find either a complete parallelism between the lactic acid value and the ordinary biological value or nutritive equivalence between various proteins for animals through a microbiological assay. *Str. faecalis* is proved to be comparatively fitted for this purpose.

77. On vitamin B_2 in the by-product of penicillin industry. Kinjiro TAMARI, Kei ARIMA, Yasuyuki KANEKO and Hiroshi WADA (Journ. Antibiotics **II-A**, 14, 1950.)

The flavin producing activity of about 30 *Peuicillinm* which produces penicillin was examined, and T_{12} and *Pen. chryso.* Q. 176 were the best. B_2 is accumulated mostly in the cake of the mycel in the purification processes.

78. Microbiological studies on penicillin production. I. A new simple method of screening test for selecting penicillin producing molds. Kei ARIMA (Journ. Antibiotics **III-5**, 285, 1950.)

The author has devised a new simple method of screening test for selecting penicillin producing molds. The procedure and the influence of various factors upon the diameter of the inhibition zone have been investigated, i.e. the standard deviation, the length of incubation period, the location of agar on the giant colony where agar cup are taken, constituent of the media and the breadth of agar cup. The coefficient of correlation between the value of penicillin potency given by this method and those by the shaking culture method is found to be rather small. The method, therefore, might be not so effective for the selection of strains with minute differences in penicillin production. But it is satisfactory for seeking high penicillin producers from various natural sources or among induced mutants.

79. Microbiological studies on penicillin production. II. Natural variation of penicillium by monospore culture method. Kei ARIMA (Journ. Antibiotics **III-16**, 348, 1950.)

The purpose of the present work is to study the degeneration in the ability of penicillin production and in the other physiological characteristics of penicillin producing molds and to find out a method for their prevention. By means of monospore culture of Q176, the author has found ten distinctly different morphological natural variants, all of which gave less penicillin yield compared with the "normal type strain".

It was also recognized that the degree of dicline in the penicillin producing ability in a degenerated stock culture of Q 176 is perfectly parallel with the rate and frequency of the appearance of morphologically degenerated colonies on the agar plates of monospore culture from it.

The increase in the rate of morphological mutation of a stock culture therefore indicates precisely the rate of the decrease in its potency of penicillin production. From the fact that the distribution curve of the penicillin potency of monospore isolates of each morphological mutant obtained above represented a normal distribution curve, it was concluded the variation of penicillin production among individual strain of one type morphological mutant is fluctuation and not genetical. It may be difficult to obtain more potent penicillin producers than the "normal type" strain only by the repetition of monospore culture method.

80. Microbiological studies on penicillin production. III. The natural variation of penicillin production molds. Characteristics of the mutants type of strains and the cause of degeneration. Kei ARIMA (Journ. Antibiotics **III-6**, 353, 1950.)

(1) Various mutants isolated by monospore culture of *Penicillium chrysogenum* Q 176 into ten genetically fixed mutant types were classified, i.e. the heavy type, the known type of the same penicillin productivity as the normal type; the light type, the steile type, the yeast type, the albino type, the flat type, and the heavy flat type of decreased penicillin productivity. The morophological characteristics of these ten types are described. Among the monospore isolates of the pigmentless saltant, which at present is used in almost all factories in Japan, all the above mutant types have been found also.

(2) Mixed cultures of the normal type strain with the strains of the other mutant types, except the brown type strain, gave low penicillin potencies, such as 100-150u/cc even at the mixing ratio of 10%.

(3) It has been also recognized that mutation rate of degenerated strains,

measured by the plate culture method, increases when the cultures are preserved for a long period as slant culture or subcultured in successive generations.

(4) Based on these findings on the mold variation, the author has established a method for maintaining a high penicillin producing strains to be used in penicillin factory, by removing mutant spores of less potency once a month.

81. Microbiological studies on penicillin production. IV. Studies on the degeneration of strain during subcultures of successive generations. Kei ARIMA (Journ. Antibiotics III-7, 445, 1950.)

Significant degenerations in morphology and penicillin productivity of Q 176 and its pigmentless saltant during subcultures of eleven successive generation were observed. Q 176 has shown gradually a sign of degeneration from the 5th generation, pigmentless saltant from the 7th. From the 9th to 11th generations the both strains have been subjected to a complete morphological degeneration and decrease in penicillin productivity as low as 100 u/cc. The rate of degeneration is considerably slower on CZAPEK solution-2% peptone agar media compared with ordinary CZAPEK solution agar. The pigmentless strain was conspicuously stable against the degeneration in morphology and in penicillin productivity, compared with the original Q 176 strain.

It must be concluded, therefore, from the facts obtained that to maintain strains always in the state of degeneration free normal type, it is necessary to carry out monospore culture before degenerations occur in the strain, i.e. at least within three or four successive transfers of sub-culture.

82. Microbiological studies on penicillin production. V. Studies on the preservation of penicillium. Kei ARIMA, Hideo NAKAMURA and Kosai OTANI (Journ. Antibiotics III-7, 451, 1950.)

(1) Various methods of preserving penicillin producing molds, especially as regards to the preservation of penicillin producing ability were studied. The factors which affect the penicillin production of molds have also been examined. The best method found was to dry up spores as quickly as possible, or spores mixed with relatively high molecular compounds, and then to preserve in a vacuum sealed tube. Provided that dessication of spores is perfect, the preservation temperature does not show any significant influence upon the penicillin productivity of the molds, between 0°C and room temperature.

(2) Preservation on Koji or CZAPEK agar slant or spores mixed with soil has caused various degrees of degeneration in morphology and penicillin productivity according to the duration of the preservation period. The degeneration occurred slightly in 6 months, but cosiderably in 12 months, and completely in 16 months. Spores of the slant culture have almost died out after three years preservation.

(3) Spores or spores mixed with horse serum and prepared by the lyophile method, then preserved in the vacuum glass tube, both gave good results.

(4) Perfect "normal type" strains which do not show any sign of degeneration, have been always isolated from the spores preserved in a bottled mixed with unsterilized farm soil, even after two years.

(5) For the perfect preservation of the mold, it is necessary to adopt alternately the socalled "passive" and "positive" preserving methods. The selection of

"normal types" strain by monospore culture must be practiced at proper intervals during the lyophile preservation.

83. Miclobilogical studies on penicillin production. VI. Studieds on sporulation media. Kei ARIMA, Kosaku TANAKA and Kotaro MASUDA (Journ. Antibiotics III-8, 493, 1950.)

(1) The sporulation mediums of penicillin production was studied, investigating the effects of various inorganic salts, sugars, organic and inorganic nitrogenous compounds and natural substances and a simple cup method for testing effectiveness of above substances was devised.

(2) Cu ion increased the sporulation markedly, and Co, Ba, Ca, Mg, Zn, Al ions were also effective considerably. Ash of woods were quite effective too. Among various sugars inulin was most effective, followed, in the order, by glucose, starch and sucrose. Among natural substances, carrot, potato, sweet potato, jerusalem artichoke, wheat bran, rice bran were as effective as Cu ion. By the use of one of these sporulation media, for instance CZAPEK-$CuSO_4$, a slant culture contained about 700-800 millions of spores, while control CZAPEC agar slant culture produced only about 400 millions. One gram of wheat bran culture contained about 3000 millions of spores.

(3) Investigation of the cultures of at least four successive transfers on these sporulation media, the author could not recognize any increase in the mutation ratio or the run down of penicillin production. In such a culture the number of spores increased two or three fold of those of ordinary CZAPEK solution agar slant culture.

(4) The degrees of sporulation on these media were tested with every mutant type of Q 176, including pigmentless saltant which forms less spore, and found that spores of mutants sporulate like the original Q 176 strain when proper sporulation media were used.

(5) Application of these sporulation media to the industrial penicillin production has been reported.

84. Studies on polymyxin. I. On the selection of effective fermentation liquor. I. Shigeo ABE and Kei ARIMA (Journ. Antibiotics IV-1, 16, 1951.)

The following results have been obtained by using *B. polymyxa* NRRL B-694, which was kindly sent from Dr. RAPER to Prof. SAKAGUCHI. When fermented at 25°C, maximum potency was reached at about the third day and remained a constant level for at least 28 days as reported by STANSLY and SCHLOSSER. While at 30°C, using the shake and surface cultures, maximum potency was reached in about 7 days and then the potency decreased gradually. When tested in a concentration of 1% pure glucose, crude glucose, sucrose, molasses, and soluble starch gave approximately equal potencies. The growth of *Esch. coli communis* was inhibited at a dilution of 1:260-1:380 after 7 days of incubation. Lactose seemed somewhat less favorable, giving inhibiting dilution of 1:50-1:100, while fructose did not give any potency. To a basal medium, consisting of 1% glucose, 0.2% KH_2PO_4, 0.05% $MgSO_4 \cdot 7H_2O$, 0.001% $FeSO_4 \cdot 7H_2O$, 0.005% NaCl, and 2% $(NH_4)SO_4$, following materials were added and potencies were determined after 7 days on the surface culture at 30°C. 6% press yeast autolysate solution (Sankyo press yeast at 40°C, for 48 hr), 0.72% dry yeast decotion, 1.5-2.0% peanut cake, skim silk, pupa cake, cotton cake, soybean cake, soybean meal, and 0.75% dry yeast, gave equally high potencies. Especially, 1.5% peanut cake and wort (Bllg 13°C), gave the highest potency of 1:900-1:1000.

Transplantation procedure of original strain has more or less effected the potency of broth. Decrease of the potency by continuous transplantation on the same medium has been observed after 3 or 5 generations.

85. Studies on polymyxin. II. Isolation and purification, and one-dimensional diffusion method of assaying polymyxin. Shigeo ABE, Kei ARIMA and Yoshifumi YAWATA (Journ. Antibiotics **IV-2**, 88-94, 1951.)

(1) Extraction and purification. Antibiotic substance is absorbed by charcoal at pH 6.5, washed with water and 50% ethanol, and eluted absolute methanol at pH 2.0. After vapourizing methanol, 10 times volume of dry acetone was added, and active substance was precipitated. After further purification, potency of 2000 u/mg was obtained.

(2) The properties of the crude polymyxin. As shown in Table 1, the crude polymyxin has a strong bacteriostatic action, especially against *B. coli communis*, *P. pseudotubersulosis* H.B. KUROKAWA, and *E. typosa*. The polymyxin is different from the other antibiotic substances in the activity against *S. aureus* TERAJIMA and *B. agri*.

Table 1. Bacteriostatic effect of the polymyxin powder (mg)
(dilution method with bouillon broth at pH 7.0).

Bacteria	Growth inhibition
B. coli communis	1:180,000—1:200,000
Bacillus agri	0
Kleibsiella pneumeniae	1:5,000—1:10,000
B. pyrocyaneus (TUTISHIMA)	1:3,000—1:4,000
Staph. aureus, 209 P	0
Staph. aureus TERAJIMA	0
B. dysenteriae (SHIGA)	1:7,500—1:10,000
Salm. paratyphi B	1:6000—1:10,000
Brucella melitensis	1:8,000—1:10,000
Brucella abrtus	1:12,5000—1:15,000
P. pseudotuberculosis H.B. KUROKAWA	1:160,000—1:180,000
Eberthella typhosa	1:160,000—1:130,000

(3) One dimensional method of assaying polymyxin. The procedure applied is essentially similar to that described by TORII et al, working with penicillin. The authors have developed a suitable method for the assay of polymyxin.

86. Studies on amylases of various species of molds. Hiroshi OKAZAKI

Part I: Classification of molds into five types after the manners of starch hydrolysis (Journ. Agr. Chem. Soc. Japan **24**, 88, 1950.)

Part II: Tripartite analysis of starch hydrolyzates by 5 types of molds (Journ. Agr. Chem. Soc. Japan **24**, 201, 1951.)

87. Studies on protein synthesis by molds. Part 1. Kin-ichiro SAKAGUCHI Hiroshi OKAZAKI and Takashi IWAZAKI (Journ. Agr. Chem. Soc. Japan **24**, 77, 1950.)

88. On the inhibitory action of iron for streptomycin production. Toshinobu ASAI, Takeshi TAKAHASHI and Hiroaki IWAMOTO

Part I. The forms of iron and their inhibitory actions (Journ. Antibiotics **III** Suppl. B 25, 1950.)

The inhibitory actions of iron for streptomycin production are divided into three types with the forms of iron compounds. In the case of streptomycin production, it is impossible to discuss the inhibitory action of steel tank by the experiments of ferrous sulfate. It must be colloidal iron or ferrous ion that shows inhibitory action for streptomycin production. The charge of colloidal iron dissolved in WAKSMAN's medium is negative and the adsorption of iron by mycelium is slight. Iron gives the inhibitory action for streptomycin production specially and inhibits the growth slightly.

Part II. The inhibitory action of Fe-colloid on the growth. (Ibid. 31.)

The course of cultivation with iron rich media and the influence of iron upon respiration and growth were investigated and the conclusion was arrived that the inhibitory action of iron can be explained by a colloid chemical phenomenon.

Part III. Some countermeasures. (Ibid. IV Suppl. A 7, 1951.)

The countermeasures for inhibitory action of iron on streptomycin production have been studied. The chrom steel as the material for fermenter, corrosion inhibitors and electochemical protection were employed.

89. Studies on the pseudooxidative bacteria. Yônosuke IKEDA (Joursn. Agr. Chem. Soc. Japan **24**, 51, 101, 147, 1950.)

Part I. Selection of new oxidative bacteria.

Among 38 bacteria tested, (1) *Ps. gluconicum* oxidized glucose to gluconic acid, (2) *Ps. fluorescens* and *S. marcescens* (*B. prodigiosus*) oxidezed gluconic acid to 2-ketogluconic acid, and (3) *Ps. oryzae*, *S. marcescens* and *B. carotovorus* oxidized ethanol to acetic acid. Besides them, *B. mesentericus* produced more than 30% acetylmethylcarbinol, not from mannose, as formerly reported, but from mannitol.

Part II. Production of 2-ketogluconic acid by *Ps. fluorescns* and *S. marcescens*.

Production of 2-ketogluconic acid from glucose was studied. By shaking culture *Ps. fluorescens* and *S. marcescens* produced 80 and 75% 2-ketogluconic acid, respectively. But by surface culture, the production of 2-ketogluconic acid was very small or none.

Part III. Acetoin fermentation.

Production of acetylmethylcarbinol was studied. Among three bacteria (*B. mesentericus*, *Ps. cyanogenes* and *S. marcescens*) *B. mesentericus* was the most active and produced 10-20% acetylmethylcarbinol, but it took many days.

Part IV. Studies on the difference between *Euglucconobacter* and *Preudomonas*.

Dr. ASAI classified such bacteria as *Eugluconobacter* which could oxidize glucose

to gluconic acid, but not oxidize ethanol to acetic acid. According to the classification of KLUYVER and VAN NIEL these bacteria have a close relation to *Pseudomonas*. The difference of these bacteria were studied.

Part V. Glucose and gluconate dehydrogenases of various oxidative bacteria.

Glucose and gluconate dehydrogenases of three types oxidative bacteria were studied by THUNBERG method. (1) *A. suboxidans*, which oxidize glucose to gluconic acid and bluconic acid to 5-ketogluconic acid, has powerful glucose dehydrogenase, and gluconic acid dehydrogenase appears later. (2) *Ps. gluconicum*, which oxidize glucose to gluconic acid, has glucose dehydrogenase, but not so active as *A. suboxidans*. The gluconic acid dehydrogenase is absent. (3) *Ps. fluorescens*, which oxidize glucose to gluconic acid and gluconic acid to 2-ketogluconic acid has powerful gluconic dehydrogenase, but the glucose dehydrogenase is very poor. (4) Glucose and gluconic acid dehydrogenase of *S. marcescens*, which oxidizes glucose to 2-ketogluconic acid by submerged culture, are not detectable. It is supposed that dehydrogenases of this bacteria are not so constitutive as others.

Part VI. A classification of oxidative bacteria.

As the result of studies on *Pseudomonas* and *Serratia*, the following conclusions have arrived: (1) Some of them have oxidative activities, but they are very low as compared with *Acetobacter* and *Gluconobacter*, (2) their activities of these bacteria are very variable and often disappear, so that they are not so constitutive as those of other *Acetobacter* and *Gluconobacter*, (3) their biological characteristics are very different from *Acetobacter* and *Gluconobacter* and (4) it may be better to call them as "Pseudooxidative bacteria" from their oxidative characteristics.

The classification of pseudoxidative bacteria

	Genus	Subgenus
Homooxidative bacteria	*Acetobacter*	*Euacetobacter* *Acetogluconobacter*
	Gluconobacter	*Gluconoacetobacter* *Eugluconobacter*
Pseudooxidative bacteria	*Phytomonas*	Glucono-type
	Pseudomonas	Glucono-type Ketoglucono-type Aceto-type
	Serratia	Ketoglucono-aceto-type

90. Studies on the aerobic mesophilic cellulose-decomposing bacteria. Part III. Some information about cellulose-decomposition by the cellulose-decomposing bacteria and their metabolism. Toshinobu ASAI, Koichi YAMADA, Kiyomoto UEDA and Tatsuo OKAMOTO (Journ. Agr. Chem. Soc. Japan **23**, 549, 1950.)

There were selected several strains of bacteria, which decomposed the cellulose vigorously, by the shaking culture method. Using two strains (*Pseudomonas* No. 306 and *P.* No. 107) which showed the most intensive decomposition on inorganic nitrogen sources, the optimum culture condition was decided. The main products of cellulose decomposition by *Pseudomonas* No. 306 were confirmed as CO_2 and bacterial gum. The quantity of CO_2 gas reached to about 70% or more to the exhausted cellulose. From the quantity of CO_2 formed in the glucose culture and remarkable quantity of

glucose formed from the cellulose by enzymic action, it is considered that the cellulose was decomposed to glucose and then metabolised into CO_2 and water. Owing to the inhibiting action of glucose on the cellulose decomposition and little accumulation of glucose in the culture solution, it could be assumed that glucose formed from the cellulose was metabolized instantly. The oxidative ability of these strains, viz., the formation of 2-ketogluconic acid from gluconic acid but not from glucose was found.

91. Microbial degumming of fibers. Part IV. Retting of manila hemp by mold and wood destroying fungi. Yoshinobu ASAI and Shozo NAKAMURA (Journ. Agr. Chem. Soc. Japan **23**, 349, 1950.)

The isolation of an useful mold from the contaminants of wood destroying fungus culture on the saw dust was carried out. This mold belongs to a variety of *Aspergillus niger* and shows the most excellent result for the retting of manila hemp than any other molds and wood destroying fungi which were tested in our experiment. For the preparation of inoculum, the solid culture method on saw dust containing some nutrients, i.e. the powder of stalk and leaf of sweet potato, alcohol stillage and husk of tea leaf was adopted. It was confirmed that these nutrients were utilized to promote the growth and enzymic action also in the course of main retting. The conditions of retting are as follows, viz. the quantity of liquid medium added is about four times to the raw fibers, the temperature lies between 25°-30°C, the pH range is about 5-7, and the time required for retting is about 8-10 days. The optimum degree of retting is indicated from the decreasing ratio of lignin content, that is, 30-45% of its decrement is suitable for the spining. The yield of fibers is about 90% to raw materials.

Part V. Retting of ramie fiber by molds. Toshinobu ASAI and Teiji NAKANISH (Ibid. **23**, 354, 1950.)

An useful mold for retting of ramie fiber was isolated from the cotton stalk. This mold belongs to a variety of *Asp. varians*. Several conditions of retting were investigated and it was confirmed that the optimal pH was about 3.5 and the optimal temperature lied between 35° and 37°C. The retting is finished perfectly in 3 days under the optimal conditions. Addition of nutrients is not necessary, because the raw ramie fibers contain sufficient nutrients for the growth and enzymic action of the mold. An extracted enzyme solution is also useful for retting.

Part VI. Retting of mulberry fiber by *Aspergillus niger*. Toshinobu ASA Sadamu SANO and Goro INOUE (Ibid. **23**, 308, 1950.)

The mulberry fibers are degummed perfectly by *Asp. niger* var. *cha* (cha means tea in Japanese). It was confirmed that in the retting course an appreciable quantity of oxalic acid was produced accordingly to the decomposition of pectin and allied substances contained in the raw fibers. The production of oxalic acid reaches 2-3% of raw fibers. As the result of selection of *Asp. niger* for the degumming purpose it was found that the strong acid producing strains generally showed the great activity.

Addition of $CaCO_3$ to neutralize oxalic acid produced in the fermentation stops almost perfectly the action of protopectinase and pectinase of *Asp. niger*, so it may be said that not only the actual pH range of the retting is in acidic side but also the oxalic acid itself acts effective in the degumming course. In truth, the oxalic acid

decomposes the protopectin into water soluble pectin conspicuously. It was confirmed that the optimal pH of protopectinase of *Asp. niger* var. *cha* was about pH 3 and that of pectinase was in the range of about pH 3-5. According to the fact described above, the degumming action of *Asp. niger* is due to its enzymic action especially in the acidic side which is influenced by the oxalic acid itself plays the significant rôle in the retting course.

Part VII. Retting of ramie-fiber in submerged enzyme produced by *Aspergillus niger.* Toshinobu ASAI and Hiuga SAITO (Ibid. **23**, 404, 1950.)

The microbial degumming of ramie fiber with a strain of *Aspergillus niger* isolated from the raw ramie was investigated. The submerged culture-fluid was used for that purpose, so that the retting-time may be saved and the black spores may not damage the fiber. In the shaking culture, the production of depectinizing enzyme is accelerated by using alkali-scouring-waste-liquor of ramie, waste of the industry, as culture medium. The addition of stillage as nutrient is highly effective. The less the amount of glucose added to alkali-scouring-waste-liquor, the basal medium, the more the amount of protopectinase was produced, so far as the development of the mold and the production of oxalic acid were concerned. It is suggested that glucose is useful for the growth of the mold, but not for the production of the enzyme, and that the small ratio of C/N is preferable. The highest activity of protopectinase out of the influence of oxalic acid was obtained on the following cultural conditions: medium, A.S.W.L. 100 + glucose 2 + peptone 1; initial pH 5.2-7.6; temp. 29-35°C. Though the conditions of retting are not yet fully studied, it can be expected cooperative effect of the enzyme and oxalate produced in the culture, so that the fiber may be degummed in shorter time than a day at the temperature as low as 30-40°C.

92. Fodder yeast production from sulfite waste liquor by the Waldhof fermentor. Koich YAMADA (Journ. Ferment, Ass. **8** (23), 13-15, 1950.)

50 liters Waldhof fermentor was used for the fodder yeast production obtaining good results. Ammonia and Ca-superphosphate were available as the nutrients, especially when KCl and rice bran extract were added. The yield of dry yeast were about 40% for the total sugar and about 60% for the sugar fermented.

III. Agricultural Economics

Abstracts Nos. 93

93. Problems on Land Reform. Yasuo KONDO (pp. 235, Yuhikaku, Tokyo, 1951.)

Part I. Characteristics of Land Reform: The Japanese landlordism which has for centuries paralysed the rural economy was abolished by the Land Reform. Millions of tenants got what they wanted most. The Land Reform, which was one of the most important occupation policies of SCAP, has given farmers the stability. And the Land Reform Program, which was deemed most radical in its appearance, has proved to be useful to make most conservative farmers standing against the aggression of reds. The widespread ownership of land is the secret of it. However, farmers remain as the embarkment against the communism so long as they are stable

in their economy with the impressment of productivity in conformity with the economic development. Has the Land Reform, proved to be a stimulus to improve the productivity of agriculture in this country? The answer says "No". The Land Reform has not brought the agricultural reform with it. The author asserts that the state administration on land is essential to improve the agricultural productivity in this country.

Part II. Three surveys concerning agricultural land rent and transfer of agricultural land during and after the Land Reform: The yearly transfer of agricultural land by sale including the transfer of cultivation right with and without the Governer's permissions are roughly estimated at 3% for 1950. The general tendency of the increasing transfer of agricultural land may be said of divergent character, but we may also speak of land accumulation in the districts where the landlordism had been strong and of tint of feudalism.

During 1949, 1950 and 1951 The transfer of land by sale and lease took a tendency towards the free transfer in consequence of the laissez-laireism of the Government. There appeared the black market price of land or rent. However, it was noticed by the author that the price of the agricultural land ran up beyond reasonable level while the rent stays in most cases within the limit of official standard. The former may be the result of the desperate competition among land hunger peasants, while the latter may be attributed to the controlling capability on the part of the agricultural commissions and peasant's unions.

With the task of reducing farm tenancy completed, the Japanese Government modified The Land Reform Program to meet the long term land tenure requirement by decontrolling agricultural land prices and changing the system of government purchase and resale of the agricultural land to a compulsory system. Under this system, the transfer is to be effected between individuals, but with strict restriction as to who may acquire the land and how much may be held, limitations on retention rates and eligible purchasers remaining unchanged. The administration of compulsory sales is being done by the local Agricultural Commission. The author points out that the task of administration of compulsory sales of land with price decontrol is more difficult than the government purchase for resale. The land should be put either under decontrol of transfer or under strict control for the purpose of planned economy.

Part III. Legal advices concerning the Land Reform Problem: Several landlords are going to law with the government proclaiming that the price of land paid by the government under the Land Reform is too low and violating the Japanese Constitution which guarantees the private property to be fairly compensated when it is requested for public services. The author thinks the official price of land is fair inspite of the inflated price of rice, if the ordinary rewards and profit for the labour and capital are permitted to farmers, and if the base of land price is put upon the profit by farming.

Other landlord is instituting a law suit against the government that the price of unreclaimed land is too low when it is ordered by the Government Ordinance to be estimated at less than 45 percent of that of the agricultural land near-by. The author asserted the Ordinance is fair by consulting the relation between them in prewar time, and by referring to the economy of the agricultural population.

IV. Agricultural Engineering

Abstracts Nos. 94—112

94. A study on the treatment of acidic water acting upon a paddy-field. Masuji AKIBA (Jour. Agr. Eng. Soc. Jap. **18** (4), 254-256, 1951.)

The experiment was carried out on the treatment of the acidic water, coming from Nishiazuma Mine in Yamagata Prefecture for the use of irrigation. The method used in this study is to percolate the water deep into the earth by boring. In August 1950, the relations between water volume, water level and time of borings at 4 points was investigated. It is supposed as the result that the straight parts are to be pressure water and the curved parts are to be free water. The details, however, are not as yet clear and further investigation for measurement of the volume of percolation water and water level of the well with over 100 wells shall be made in order to ascertain what parts of well side, water percolates by the apparatus of electric resistance and, further, to seek for water level as well as interference of wells in the future.

95. The effect of preserving water temperature in Tateshina Reservoir in Nagano Prefecture. Masuji AKIBA and Shozo NOGUCHI (Rept. Special Committee, Sci. Promot. Soc. Japan, 1950.)

The reservoir is about 1400m high above the sea level. Its catchment area is 495 ha., full water area 31.06 ha., dam height 11.06m and irrigating area 512 ha.

The Tateshina region is cool in summer, and days which registered above 20°C of average air temperature are only 10 days in a year. So the irrigation water is also so cold that rice-plants often suffer the damage owing to the low temperature of water. The investigation was carried out on the temperature of water in the reservoir in summer of 1949 and the result obtained was as follows:

(1) The depth of this reservoir is 2.0-8.0m, and the "Thermocline" is found to be about 2.0-5.0m by measurement.

(2) At the depth of 1.5-2.0m from water surface, water temperature rises in the daytime, while it falls at night.

(3) The limit of water depth which affects the temperature rise is about 4.0m during 48 hours in summer.

(4) The optimum water depth for the method of taking out warm water seems to be about 2.0m from the water surface.

(5) The topography and the direction of wind affect the water temperature of the reservoir.

(6) If springs gush out on the way from the outlet of the reservoir to paddy-field, the water temperature often falls.

96. A comparative study of preserving water temperature in reservoirs. Masuji AKIBA and Shozo NOGUCHI (Rept. Special Committee, Sci. Promot. Soc. Japan, 1951.)

The aspect of preserving water temperature in the two reservoirs, having different water depth, was examined in this study.

The smaller one (Higashikaneya Reservoir, Toyama Prefecture) has water area 4903 m^2 and water depth 2.0m, being designed for warming water.

The change of water temperature in it is as follows: as for horizontal distribution of water temperature, the farther away from the inlet of the reservoir, the higher becomes the temperature, as for vertical distribution of water temperature, the nearer the water surface, higher becomes the temperature in the daytime, but temperature difference between them is negligible at night and for this reservoir, average water temperature rise is 4.24°C for 24 hours in the summer season.

Another reservoir (Akasofu Reservoir, Toyama Prefecture) has water area 8.2 ha, and maximum water depth 26.0m, dam height 31.8m and is not designsd for taking warm water especially. The results are as follows: cold water inflow mixes with storage water at about 50m from the inlet, the "Thermocline" is found to be 5.0m-6.0m by measurement and water temperature falls about 1.0°C every one meter from surface to the Thermocline.

97. Some experiments on the irrigation of fields. Masuji AKIBA, Fujio YAMASAKI and Shozo NOGUCHI (Rept. Kanagawa Prefecture, 1950.)

The experiments were carried out to determine the variation of soil moisture, the conveyance loss of irrigation water in the earth canal and the effect of irrigation water for prevention of rime when fields were irrigated.

After examination of the water content in soil with the irrigation water of 30 mm, 60 mm and 90 mm in depth respectively, the fact was made clear that under the climatic conditions of Kanagawa Prefecture it is better to apply a smaller amount of water frequently than a large amount of water at one time, to cultivate crops from the standpoint of economical use of water.

As the results of determination of discharges at the two points 40m apart in the earth canal by using a triangular weir, the conveyance loss for the 10m is as follows:

Discharge (cm^3/sec)	Conveyance loss for 10m length (%)
65.6	15.25
330.0	6.30
692.2	4.90

Comparing the irrigated lot and the non irrigated lot, it is observed, that the former is more favorable for preventing rime. When irrigating two kinds of water volume, that are 15 mm and 30 mm in depth, the latter is greater than the former for rime growing during 4 hours, while the difference is negligible after 6 hours. It is better to apply water to prevent rime growing just after than before the growing of rime.

98. Functional relation between electrical resistance and soil moisture. Hitoshi FUKUDA (Journ. Appl. Physics, Japan **19** (9-12), 262-264, 1951.)

The relation between electrical resistance and soil moisture is experimentally known to be expressed by GARDNER'S formula,

$$W_1 = \sqrt{\frac{W^2 R}{R_1}}$$

in which W=standard watercontent (%), R=elec. resistance at watercontent W(%), W_1=watercontent (%) at elec. resistance R_1, but the theoretical explanation of this formula has not yet been made. This paper intends to try it by a statistical method, considering (1) the number of the pass of electrical current in soil mass and distribution of the pass there, (2) the relation between electrical resistance and length of each pass. The last form induced by the author is as follows:

$$R \propto \frac{1}{W^2}$$

Thus, GARDNER'S formula has been theoretically explained.

99. Capillary movement of soil water in circular irrigation as three dimentional diffusion. Hitoshi FUKUDA (Journ. Soc. Agric. Meteorology, Japan **6** (1), 1-5, 1950.)

This paper intends, by the theory of three dimentional diffusion, to determine the watercontent capillarilly held and its change in the ground, where irrigation was fast practiced through a circular area. The theoretical formulae have been derived, considering the special conditions of soil moisture constants as a change of a capillary conductivity in soil.

One of these formulae to show a watercontent at any depth beneath the center of an irrigated circle is as follows:

$$w=\frac{100\beta Q}{2\sqrt{\pi kt}}e^{-\frac{z^2}{4kt}}\cdot(1-e^{-\frac{a^2}{4kt}})$$

where w=watercontent % (wt.), β=apparent specific gravity of soil, Q=applied water-quantity cc/cm^2, k=capillary conductivity cm/sec, t=time after irrigation sec., z=depth beneath the soil surface cm., a=radius of irrigation area cm.

The discrepancy between the formula and the corresponding experiments has been explained principally by the presence of the field capacity. But a lot of problems, especially on the functional relation of capillary conductivity to soil moisture, remain still unsolved.

100. The application of the profit-water curve to irrigation projects. Hitoshi FUKUDA (Agr. Engineering [Americ. Soc. Agr. Eng.] **31** (7), 350-552, 1950.)

101. Relation between soil moisture and electrical capacity of underground condenser. Hitoshi FUKUDA (Journ. Appl. Physics Japan **19** (3), 33-36, 1950.)

It was reported already by the author of an experimental formula induced by a beat method, in which any soil watercontent in situ can be calculated by electric capacity of a condenser buried at any depth in field with some dielectric loss and soil temperature, namely this formula is

$$W=A_1-A_2D-A_3t+A_4Dt$$

in which W=watercontent (%) of soil, =reading of a condenser in a circuit with wave length 900 m., t=soil temperature (°C). And its theoretical explanation had been remained unsolved. This paper was dealt with successful study in the explanation by GARDNER'S formula which contains the relation between electrical resistance and watercontent of soil. Thereafter this GARDNER'S formula was also proved theoretically.

102. An analysis of furrow irrigation. Hitoshi FUKUDA (Journ. Agr. Engin. Soc. Japan **18** (1), 26-29, 1950.)

The theoretical formulas expressing the relation between the velocity of advancing water in a furrow and furrow width, water quantity, water depth and vertical, horizontal velocity of percolation were derived and the formulas were proved experimentally to be correct in this study.

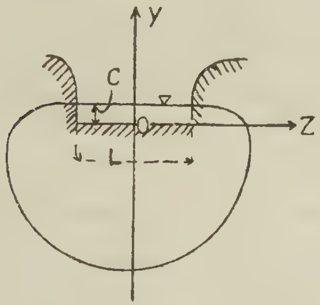


Fig. 1

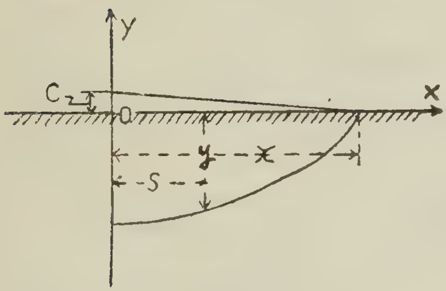


Fig. 2

In Fig. 1 and Fig. 2 the following notations are used, namely

c = water depth at the head 0 of a furrow (m).

L = Water width of a furrow (m).

S = any advanced distance from the point O (m).

y = percolation depth (m) at the distance S.

q = inflow water m³/sec.

x = advanced distance (m) from the point O in time t.

One of the induced formulas is shown by

$$X=Ar\left(t-\frac{1}{a}\right)+A-A\left(1-\frac{r}{a}\right)e^{-at} \quad \text{......... (1)}$$

in which $A=q\Big/\frac{Lc}{2}a$, $a=\left(1+\frac{\alpha c b_1}{Lc/2}\right)r$,

and α = water quantity (m³) in unit volume of soil, b, b_1, and r are coefficients combined in the assumed equations showing vertical and horizontal percolation of water, namely

$$y=b(1-e^{-rt}) \quad \text{.............................. (2)}$$

$$z=b_1(1-e^{-r_1t}) \quad \text{.......................... (3)}$$

From the formula (1), it can be seen that, this formula has an asymptote such as $x_1=Ar\left(t-\frac{1}{a}\right)+A$, and x will be able to extend infinitely, if other factors permit.

Another formula is expressed by

$$x=B(1-e^{-kt}) \quad \text{.. (4)}$$

in which $B=q/\alpha A_1^2$, $\frac{1}{k}=\frac{Lc}{2}\cdot\frac{1}{\alpha A_1^2}$ and A_1 is a coefficient in other assumed equations $y=A_1t^{1/2}$, $z=A_1t^{1/2}$.

In this formula, e^{-kt} becomes very small with the increase of t, and x will approach to its max. value $\frac{q}{\alpha A_1^2}$, namely this formula represents a curve with an asymptote such as $x_1=q/\alpha A^2_1$.

It is proved experimentally at the sandy and loamy field, that the formula (4) is more accurate than the formula (1), though both are practically useful.

103. An effect of thunderstorm on upland rice culture in the Northern Kanto District. Hitoshi FUKUDA (Agr. and Hort. **25** (9), 21-22, 1950.)

It is a well-known fact that the yield of upland rice is usually expected to be abundant in Gumma, Totigi and Ibaragi Prefectures in the Northern Kanto District in Japan. The frequency of thunderstorm in the above mentioned regions is in the

first rank in Japan, and the rainfall is brought to the upland rice fields in the advancing course of thunderstorm in July and August.

The relations between the number of days, times in which the thunderstorm visits and the yield of upland rice are shown in Table 1.

Table 1. Correlation coefficient between the days of thunderstorm at Gumma Prefecture in June and the yield in Gumma, Tochigi and Ibaragi Prefectures.

Name of prefecture	Years observed	Confidence coef. %	Coef. of correlation in samples	Coef. of correlation in population
Gumma	50	95	0.491	$+0.667>\rho>+0.246$
Totigi	50	95	0.592	$+0.747>\rho>+0.375$
Ibaragi	50	95	0.404	$+0.613>\rho>+0.141$

The table shows that there is a significant relationship between the proceeding factors. Moreover, the empirical formulas are obtained as follows:

Table 2. Empirical formula.

Prefecture	Formula	Errors. (±)
Gumma	$Y=3.40\ X+75.21$	18.21
Totigi	$Y=5.14\ X+63.11$	15.72
Ibaragi	$Y=1.11\ X+92.82$	23.45

where X=number of days of thunderstorm in June in Gumma Prefecture, Y=specific yield, namely, a ratio of the yield to the average of that in recent five years. Thus, the yield of upland rice will possibly be anticipated there.

104. Irrigation experiment on the upland rice (3). Teiji TANAKA and Hitoshi FUKUDA (Agr. and Hort. **25** (6), 497-499, 1950.)

The effect of irrigation upon the production of upland rice has been examined in these several years in the experiment field at Ishioka, Ibaragi Prefecture. This paper intends to report one of the results obtained in 1949.

The surface soil of the field is loamy about 30 cm deep, under which brown loamy subsoil prevails to a considerable depth.

The amounts of rain in July and August were smaller than the averages of recent 20 years, their probabilities being 0.8-0.7 and 0.9-0.8 respectively. Each experiment plot was irrigated with 10mm, 10mm and 20mm water every 10, 5 and 5 days respectively, and the non-irrigated plot was placed as a standard.

The plot, irrigated with 10-20mm water every 5 days, had about 10% greater yield compared with the non-irrigated plot, but the decisive relations are expected to be made clear in the near future.

105. On the duty of water for "Semi-Land Method" of cultivating rice plants. Fujio YAMASAKI and Kagato SHINZAWA (Journ. Agr. Eng. Soc. Japan **18** (1), 30-35, 1950.)

Rice-plants are commonly cultivated in paddy-fields filled with water by the so-called "Transplantation Method". But their seeds can be sown between the furrows in barley fields, and they are kept growing under upland field conditions until the barley is harvested, and then are irrigated just as in the "Transplantation Method". This is called "Semi-Land Method".

This method has quite naturally developed in the regions frequently visited by drought. It has, moreover, many advantages; for examples, it saves the trouble of transplanting rice-seedlings, it makes easy to mechanize the cultivation and it is believed to make land more productive. But such a question that the "Semi-Land Method" might want more water than the "Transplantation Method" still remains to be solved.

In general, more water evaporates in the "Transplantation Method" than in the "Semi-Land Method", but in the latter seepage is greater, when no proper means to prevent it is devised, so that it is quite evident that, in case of impermeable soil the "Semi-Land Method" requires less water and in case of the "Semi-Land Method" permeable soil it can not be easily decided which method requires more water. If requires more water, it may not be possible to make use of the water supply facilities for the "Transplantation Method". And in such case the water supplying system must be planned in preventing the seepage.

From the standview points above stated some of the model cases in Okayama Prefecture, where the "Semi-Land Method" has been widely in practice, were investigated.

106. On the reclamation under the capitalistic agricultural system. I. The study of the cost of land improvement. Kagato SHINZAWA (Rept. 122, Land Section, Resources Council, Economic Stabilization Board, 1950.)

The land implovement is the fixed capital, but its revolution form differs from the general fixed capital. Its value revolves by the lease, but its function has remained on the land for a long time. Such a character has the peculiar influence on the price of land products, and accordingly it has the influence on the differential and absolute rent. And the grant in aid and government operated project for the land improvement lower the average price of land products.

107. A study on the flow-motion of grain-mass on inclined plane. Fusanobu SHOJI (Journ. Soc. Agr. Machin. Japan **2** (4), 134-142, 1950.)

An experimental study on the flow-motion of grain-mass (unhulled and hulled rice) on the inclined plane was carried out to solve a basic problem concerning the function of the grain separater with plane sieve and rice-bran sorting screen. Such materials as sheet-zinc, wooden plane and wire-netting plane were used in order to get inclined plane, and the flowing velocity (v) of grain-mass in the variation of angles of inclination (θ) was measured by the following formula.

$$v=\frac{l}{\cos\theta}\sqrt{\frac{g}{2(h-l\tan\theta)}}$$

l: abscissa of grain-flowing curve,
h: ordinate „ „ „ ,
g: acceleration of gravity.

The flowing velocity (v) is affected by the volume of grain-mass, the width and

length of inclined plane even in the same condition of inclination, but it is always constant all over the length of inclined plane.

There are two types of flow-motion of grain-mass on inclined plane, i.e. laminar flow-motion and turbulent flow-motion. They are classified at the critical angle of inclination and their relation is similar to that between ordinary flow and jet flow in an open channel.

The characteristic of turbulent flow-motion is utilized in the rice bran sorting screen and the characteristic of the laminar flow-motion is used in the grain separater with plane sieve.

108. On the mechanism of the salt field, the so-called "Irihama". I. The efficiency of salt production using the fine sand "Sansha". Jiro SUGI (Bull. Soc. Salt Sci. Japan 4 (3-4), 62-70, 1950.)

The fine sand "Sansha", which is placed on the sand bed, is useful to increase the evaporation area and to crystalise salt easily from the sea-water coming through sand bed. It is also possible to increase the efficiency of salt production by reversing or raking up the sand to evaporate moisture and not to fall down the available matter at night.

The improvement of operating "Sansha" has proved a possibility of obtaining 10-40% more salt and the efficiency of salt production rise about 75% by the more careful treatment of "Sansha".

109. On the mechanism of the salt field, the so-called "Irihama". II. The heat conductivity of salt field bed. Jiro SUGI (Bull. Soc. Salt. Sci. Japan 4 (6), 6-29, 1950.)

The distribution of temperature on the salt field bed forms a fan-shape graph. The vertical change of temperature is divided into three zones: the highest in the 2-3cm layer under the surface, medium in the 4-8cm layer, and constant under 10cm of the soil. The thermodynamic values of salt field are as follows:

Heat diffusivity	$K^2=0.005\text{-}0.01$.
Heat conductivity	$k=K^2\rho C=0.002\text{-}0.006$.
Velocity of conductivity	$V=0.0008\text{-}0.0014$cm/sec.
Efficiency of salt field	80% of the solar energy.

110. On the utilization of magnesium hydroxide and magnesia as the various stocks of rubber. Jiro SUGI (Journ. Salt Sci. Japan (10), 10-23, 1950.)

In rubber industry magnesium basic carbonate has been used in various stock of rubber. Magnesium oxide had also been useful as accelerator before the organic one was found. But neither in our country nor in foreign countries magnesium hydroxide and magnesia have not been used as the rubber stock. The test was made for the utilization of these materials, which were specially made from bittern, as the accelerator of ebonite and rubber and the azctovator of organic accelerator and filler in rubber industry.

As the magnesium source magnesium chloride solution was used, which was prepared by the treatment of bittern with addition of barium chloride solution removing the sulphate compounds to keep the amount of magnesium equivalent of milk line and then warmed at 70-80°C while stirring. After washing thoroughly with water, the precipitates were filtrated and dried to block of magnesium hydroxide. Crushed the block and screened by 200 mesh TAYLER's screen, the magnesium hydroxide powder was obtained.

Another portion of the block is ignited in an electric oven for 2 hours about 800°C until it becomes magnesia. After cooling it, the block of magnesia is crushed and screened by 200 mesh TAYLER's screen and then powder of magnesia was obtained.

The results of the experiments are as follows:

(1) The test of $Mg(OH)_2$ and MgO as the accelerator of soft rubber. Cure condition is 3 kg/cm^2 steam pressure at 143°C, the accerelation was exceedingly great in calcined lime stone stock and next came MgO (the sample) stock, MgO (for industrial use) and $Mg(OH)_2$ (the sample) in order.

(2) The test of $Mg(OH)_2$ and MgO as the filler of rubber. M (mercaptobenzol) stock was examined. Cure condition was same as mentioned above. In this case tensile strength, modulus, elongation, hardness, erosion loss, elasticity, tear strength and permanent set were measured. $Mg(OH)_2$ and MgO (both the samples) were inferior to magnesium basic carbonate in tensile strength, hardness and erosion loss, but superior in elongation, elasticity, and permanent set.

111. An investigation of the Inose Saltmaking Factory. Yoshichiro YASUDA (Rept. 33 Special Committee, Sci. Promot. Soc. Japan **14**, 124, 1951.)

The INOSE Saltmaking Factory is the largest factory of Japan operated under the thermo-compression system which is equiped with the IV stages 3,000 hp turbo-compressor (compressing capacity of 36 ton/hr. of steam from 1 kg/cm^2 to 1.8 kg/cm^2, and driven directly by the 3,000 hp, 3600 r.p.m. 2 pole induction motor).

A considerable vibration of the direct-coupled motor and compressor at some range of r.p.m. near the critical speed was noticed. This motor had been adjusted to have some range of critical speed as reported already, because when it was adjusted to have a minimum vibration at the critical speed, it had pretty large vibration at the rated speed and when it was adjusted to have a minimum vibration at the rated speed, it had considerable large vibration at the critical speed. So the factory of the motor adjusted to have an average condition of the above mentioned and the motor had some range of critical speed.

The critical speed of the turbo-compressor is not much different from that of the motor. Thus the range of the critical speed of the motor covers the critical speed of the turbo-compressor. Consequently, they came to have the resonance critical speed. After the running of this compressor the blades of this turbo-compressor was checked. The blades of this turbo-compressor were changed twice which were made of 18-8 orstenite-steel. And this third blades are made of nickel-chrome steel. Some cracks were found on the blades at the mouth of the first stage, but as the crack direction is not radial but peripheral, it was found not so seriously dangerous. But it should be recommended that a runner is to be reserved for the accident.

As the supply of the electricity to this factory was discontinued, the running cost has become considerably high, because heating up and cooling down give less profit to the enterprise of this factory.

The thermo-compression system is the most economical evaporating system. So this factory should be considered as the pilot plant for rendering service to the undertaking of this kind.

112. A theory of salt production from sea-water. Yoshichiro YASUDA (Ref. No. 2, Agr. Inst. for Asia, 1951.)

This paper deals with the theoretical analysis of designing the salt-field in Madoera Island.

The results of analysis with the sea-water around Madoera Island proved that the chemical composition of the water is remarkably alike to that of Mediterranean Sea. So it seems without doubt that the USIGLIO's evaporating trial with the sea-water of Mediterranean can be adapted to treat the Madoera Sea water, even the total content of salt is 31‰ in the water of Madoera Sea and 37.65‰ in Mediterranean Sea. For the increase of the evaporation caused by rising of the liquid temperature with the solar radiation cancels the decreas of the evaporation that occurred from the decrease of vapour pressure according to the concentration of salt, the amount of evaporation from sea-water is considered to be constant. To determine the values of evaporation above mentioned and of the infiltration of water into the ground, the author supposed that a pool, which has a water layer of h_0 cm with the concentration of salt α_0 gr/litre at the $T=0$, is filled with water to the depth of h cm after T days, the concentration increase to α, the amount of evaporation is V cm/day and the amount of infiltration is W cm/day, and then obtained the following equation.

$$V=\frac{(h_0-h)\log\left(\frac{\alpha_0}{\alpha}\right)}{T\log\left(\frac{h}{h_0}\right)}$$

$$W=\frac{(h_0-h)}{T}\left[1-\frac{\log\left(\frac{\alpha_0}{\alpha}\right)}{\log\left(\frac{h}{h_0}\right)}\right]$$

The values of $V=0.5$ cm/day, $W=0.025$ cm/day (at good salt-field) and $W=0.1$ cm/day (at newly constructed salt-field) for Madoera Sea water were got experimentally using the model pools and these equations.

Then the days required to make saturated brine and the quantity of the brine were calculated theoretically with several types of salt-field 1 ha. in area and the formulas in each case were obtained.

Case 1. Using 1 pond.

$$T=\frac{d}{q_1+W}\log\frac{\alpha_0 V}{\alpha_0(q_1+V+W)-\alpha(q_1+W)}$$

Where T is the days for obtaining brine of α gr/litre, d is the depth of the pond, α_0 is the concentration of the sea water, q_1 is the quantity of the saturated brine measured with the depth per day.

In this case there is a limiting value of W to obtain saturated brine. W is lower than 0.051 cm/day when $T\rightarrow\infty$ days, $\alpha_1=0$ cm/day, $\alpha_0=24$ gr/litre, $\alpha=260$ gr/litre and $V=0.5$ cm/day. So we cannot use the young salt-field to obtain saturated brine by this method.

Case 2. Using 3 ponds of equal area.

$$\alpha_1=\alpha_0\left(1+\frac{V}{W+q_1}\right)$$

$$\alpha_2=\alpha_1\left(1+\frac{V}{W+q_2}\right)$$

$$\alpha_3=\alpha_2\left(1+\frac{V}{W+q_3}\right)$$

$$q_1=q_2+V+W=q_3+2V+2W$$

$$\alpha_3=\alpha_0\left\{1+\frac{V}{q_3+2V+3W}\right\}\times\left\{1+\frac{V}{q_3+V+2W}\right\}\times\left\{1+\frac{V}{q_3+W}\right\}$$

Where q_1, q_2, q_3 are the quantity of brine with the concentration α_1, α_2, α_3 respectively. Time is calculated with the equation in the case 1.

Case 3. Ideal method.

Very many ponds are used, into which the sea water is poured by a canal of 1 meter wide without mixing.

$$Q_n = \frac{100(V+W)}{\left(\frac{\alpha_n}{\alpha_0}\right)^{\frac{V+W}{V}} - 1} \qquad \text{cm/day}$$

$$T = \frac{d}{V} \log \frac{\alpha}{\alpha_1} \qquad \text{days}$$

As the comparison with these three cases above mentioned the following table is given, where $d = 4$ cm/day, $V = 0.5$ cm/day, $W = 0.1$ cm/day and $\alpha_0 = 24$ gr/litre.

One pond	3 ponds	Ideal method
impoisible to obtain saturated brine	T=62.38 days Q=1.17 m/day	T=19.0 days Q=3.65 m/day

Case 4. Continued method.

This method is considered to be an intermediate between Case 2 and Case 3 and to use n ponds, and contracting ratio between each pond is a.

$$a = \frac{V\sqrt{\frac{\alpha_n}{\alpha_0}}}{V + W - W\sqrt{\frac{\alpha_n}{\alpha_0}}}$$

Where α_n is the concentration of the n th pond.

The calculated value by this equation agrees very much to the data obtained by the actual measurement.

V. Fisheries

Abstracts Nos. 113-130

113. Effect of electric current on fish, regarding direction, intensity, frequency and type of the current. Yoshio HIYAMA and Takaya KUSAKA (Studies of Aquatic Animals of Japan 1, 1-10, 1950.)

To get fundamental knowledge on electric fish screen, first reactive intensity, i.e. the minimum intensity of electric current by which fishes exhibit reactive behaviors, was measured by the experiments using direct and alternative currents of various frequencies (50—10,000 cycles), and various types of waves such as sine, rectangular and impulse waves.

The fish materials were Japanese common loach (*Misgurnus anguillicaudatus*), brackish gobby (*Tridentiger obscurus*), carp (*Cyprinus carpio*), rice pad minnow (*Orizias latipes*).

Beat frequency oscillator, special current oscillator, galvanometers and oscillograph were the instruments used.

The current generated by these instruments passes through the fresh water in the paraffin coated wooden tank (150 mm. long, 15 mm. wide and deep) by two metallic plate electrodes fixed at both end of the tank, so as to the current passes through where fish are kept longitudinally either ahead to the cathode or to the anode.

In the course of gradual increase of the current, the intensity at which the fish reacted, i.e. first reactive intensity, was measured.

The summary of the results is as follows:

(1) In cases of direct current and impulse wave, if the fish is located ahead to the cathode, the first reactive intensity is about 50 to 80% of when it is ahead to the anode.

(2) In cases of sine and rectangular waves, the first reactive intensity increases proportionally in linear relation to the frequency of the current. In cases of sine wave, the rate of increase of the first reactive intensity is larger than that in cases of rectangular wave. In cases of impulse wave, the first reactive intensity increases prominently in the range from 50 to 500 cycles, while in the range over 500 cycles which increases gradually in linear relation to the frequency of the current.

(3) Value of the first reactive intensity differs by fish species, however, similar tendencies were shown in all the species investigated.

114. On the life history of a mysid crustacean, *Neomysis japonica* NAKAZAWA. Masashi ISHIKAWA and Yasuo OHSHIMA (Bull. Jap. Soc. Sci. Fish. **16**, 461-472, 1951.)

This species is commonly found in the brackish water of central Japan and is important as natural fish food. Its life history was studied by examining and culturing the material collected in the vicinity of Fisheries Laboratory, University of Tokyo, in Aichi Prefecture.

The annual life cycle of this species involves several successive generations. The wintering generation is born in November or December and persists till next May, moulting about 16 times. It spawns 4-5 times in March and April, and is followed by several generations of yearlings, which recur from March through December and are finally replaced by the wintering generation. Each yearling generaton persists for about 2.5 months, moulting 9-11 times and spawning 2-3 times. Maximum carapace length (from the base of eye-stalk backwards) of 4.1 and 2.1-2.5 mm is attained by the wintering and yearling generations. Body length is linearly correlated with carapace length, and is approximately 3.66 times as much as the latter. The yearlings born in mid-summer show quicker growth and shorter life span with less moultings and smaller maximum sizes than those born in spring and autumn.

At every spawning, females receive spermatophores through copulation. The length of ovigerous period varies 6-17 days, and its correlation with the water temperature can be expressed with BERTHELOT's formula. 2-27 eggs are produced at one spawning according to the size of females, the number reduces in mid-summer, especially at lower chlorinities (1.6-3.4 ‰) rather than at higher ones (11.4-13.4 ‰). When extruded, eggs are oval (0.52×0.58 mm in average and almost colourless. When the young leave the marspium, their carapace lengths are about 0.69 mm.

115. Biological notes on the sand-eel *Ammodytes personatus* GIRARD. Yasuo OHSHIMA (Bull. Jap. Soc. Sci. Fish. **16**, 99-107, 1950.)

With the view of supplying basic informations for future studies on its stock, the biology of this fish in Ise Bay and its adjacent waters was studied. Samples were taken from the commercial catch in 1944-1948. Age can be determined from the change in the distances between the succeeding circuli on the unexposed part of the scale. These distances show cyclic fluctuation in the course of a year, and the minimum is found in the zone formed during June-December. Growth of the fish seems very slow during this period. Approximate ranges of the body length are below 8, 8-12, and over 12 cm respectively in 0-, 1- and 2-age groups. No fish over 14.5 cm are found in this region. Spawning takes place probably between late November and middle December. Post-larval stages are found in the bay and at its mouth respectively in late and middle February. Yearlings are commercially fished in the bay from middle March through early June. During the summer the fishing is suspended, and the fish are likely to stay outside the bay perhaps burying themselves in the sandy bottom. Fishing is resumed in December and carried on until next March, and both 1- and 2-age groups are taken, the latter amounting to only 2-18% of the catch (in number). Fish mature at the end of the 1st year.

Except for the adults taken in December and January, which are extraordinarily thin, the relation $W=0.00512.L^{2.082}$ stands, where L is body lengh in cm and W body weight in gram. Stomach contents consist of zooplankton such as *Calanus, Balanus nauplii, Sagitta*, and occasionally of the large planktonic diatom, *Coscinodiscus janishii*. Vertebral counts of the fish of this region differ significantly from those of Onagawa in Miyagi Prefecture and Moura in Aomori Prefecture, but not significantly from those of the Inland Sea. Major fishing gears used are beach seines, scoop nets and two-boat seines.

116. An experiment on the behaviour of fishes toward a drag-net. Yasuo OHSHIMA (Bull. Jap. Soc. Sci. Fish. **16**, 155-164, 1950.)

Some aspects of the behaviour of the fish being driven or surrounded by the drag-net were studied experimentally. A school of 20 individuals of *Aprocheilus atipes* (T. et SCHL.) of body lengths around 2.5 cm were liberated in a rectangular tank, 125.5×41×25 (depth) cm, equipped with a movable partition of netting across its width, and the behaviour of the fish was observed while the partition was shifted at a constant speed from one end of the tank towards the opposite. The netting was spread across a wire frame, and its mesh, measuring about 2.6 cm diagonally, was large enough for the fish to pass through freely. Possible disturbing factors inherent in the apparatus were assessed by control tests.

Three types of partitions were used: (a) a simplified model of a drag-net, consisting of paired wings and a rear wall to represent the cod-end; (b) the same as (a) but lacking the rear wall; (c) a simple wall of netting vertical to the long axis of the tank. When (a) or (c) was shifted at the speed in the range of 0.05-0.20 meter/sec., the majority of the fish moved along with but in front of the partition without passing through it. With (b) the fish behaved in the similar way, and the individuals passing through the opening in the partition has an influence on the distance between the school and the moving partition, and also on the time that the school driven against the wall of tank by the shift of partition takes to reorient itself towards the staying partition and pass through it.

The field experiments, in which young fishes were seined with a small drag-net in the shore water, showed that the youngs with a certain degree of locomotive ability do not fall in the cod-end, though many of them are gathered between the wings of the net. This seems to confirm the result of laboratory experiments.

117. An experiment on the shoaling behaviour in fish: The case when two homotypic shoals consisting of large and small individuals met with each other. Yasuo OHSHIMA (Bull. Jap. Soc. Sci. Fish. **16**, 195-200, 1950.)

When two shoals of the fish showing a strong shoaling habit, one consisting of small individuals and the other of large, are brought together, will they unite into a new shoal or keep separate? This problem was studied experimentally with the shoals of young *Plotosus anguillaris* liberated in a concrete tank 155×115×45 (water depth) cm. Four shoals were collected in the shore water, and the whole or parts of them were used. Mean body lengths in these shoals ranged 2.09-5.50 cm.

The results obtained are summarized as follows:

(1) Whether two shoals will unite or remain separate is determined by the ratio of the mean body length for smaller individuals to that for larger ones; its values above and below about 0.65 are respectively associated wth the union and separation of the shoals.

(2) In the cases where two shoals fail to unite completely, it is usually the small individuals that secede the mixed shoal first. And they may remain isolated from other fishes or may induce the complete separation into original shoals.

(3) The stability of the new aggregation (i.e. the united shoal) as well as the occurrence of separation depends on the relative abundance of small individuals to large ones. In general, where there are the more small individuals, relative to large ones, the longer the new aggregation is maintained and the more strongly the separation restrained.

118. On the life history of *Pandalus nipponensis* YOKOYA. Tamotsu TAMURA (Bull. Jap. Soc. Sci. Fish. **15**, 721-724, 1950.)

Pandalus nipponensis is an edible prawn of commercial importance and has been caught by deep-sea haul-seines at the depth of 300-500 m off Mie and Aichi Prefectures, Japan. With 432 specimens obtained onboard commercial seiners and at fish markets in 1946-49, some aspects of its biology were studied, including breeding season, age, growth and protandric hermaphroditism. The sampling was limited to the season of commercial operations, i.e. from October through next May.

From the data on these specimens the life history of this prawn has been concluded as follows: The eggs are spawned by 3-year old females between February and May, and are carried by ovigerous mothers until they hatch between February and April next year. Young prawns begin to appear in the catch towards the end of their 1st year, when they are sexually immature and show the carapace lengths (excluding the rostrum) around 1.2-2.0 cm. In the next fishing season, being approximately 2 years old, they are found as mature males with carapace lengths around 2.2-3.0 cm. The majority of them undergoes the sex reversal in their 3rd year, and show as 3-year old mature females in the following season. They spawn towards the end of the season, then remain ovigerous for one year, and, after the eggs hatch the next spring, mostly die off at the age of or slightly over full 4 years. Carapace lengths of ovigerous females generally lie in the range 3.6-4.0 cm, though lengths as large as 4.3-4.4 cm were reported on one occasion.

The males can be identified by such secondary sexual characteristics as: (1) a pair of developed vasa deferentia, which open at the coxa of the 5th pereiopods and, in the case of mature males, contain spermatozoa; (2) the modification of the endopodites of the 1st pleopods into the copulatory organs; and (3) the appendix masculna found on the endopodite of each 2nd pleopod besides appendix interna.

119. Studies on the ecology of *Zostera marina* and *Zostera nana*. I, II. Seibin ARASAKI (Bull. Jap. Soc. Sci. Fish. **15**, 567-572; **16**, 70-76, 1950.)

The ecological studies were carried on *Zostera marina* and *Zostera nana* in the Ikawazu-cove in Mikawa-bay. In the Ikawazu-cove, the water is rather shallow and the seasonal fluctuation in the enviromental conditions such as the water temperature or the density of the water, are great. *Zostera marina* grows in the deeper zone and *Z. nana* in the shallow tidal zone. The seasonal change in the vegetation of the both species has been traced for three years. *Z. marina* grows in February through May and becomes fertile in March and May: after liberating the seeds in May and June the most parts of the plant die out leaving the young shoots and the younger creeping stems which will flourish in next spring after the quiescence of several months. The ripe seeds drop into the sea bottom, and there they rest until next early spring when they begin to germinate. The young seedlings appear in January through April, some of them which have germinated in the earlier time are able to bring the flowering shoot in the same year. *Zostera nana*, on the contrary, luxuriate during the spring and the summer, beocmes fertile twice in a year, in the late spring and the mid-autumn. The plant becomes quiescent during the winter, and in spring the young buds and the young creeping stems begin to elongate. The seeds germinate in March and April after the dormance of several months.

In the sea, the ripe seeds of the both species cannot germinate without the dormant period, while in the laboratory they may germinate immediately by the suitable treatment, especially the diluted sea-water (5-10 Cl‰) seems to accelerate the process.

120. A new habitat of *Dasycladus* and some consideratons on its geographical distribution. Seibin ARASAKI (Kagaku [Science] **20**, 377-378, 1950.)

A rare green-alga *Dasycladus* was collected at the south-eastern coast of the Okinawa Island in 1934. In the Pacific coasts, it was the first time to discover the *Dasycladus* which had been already found at several places in the Mediterranean and in the western Atlantic coasts. The geographical distribution of this alga is discontinuously restricted into three separated regions; i.e. Okinawa in the Pacific, several places along the Mediterranean, and Bermudas-Florida-West Indies in the Atlantic. How has such discontnuity of the geographical distribution occurred?

The palaeobotanists have reported that the majority of the *Dasycladaceous* algae have been preserved as fossils in the rocks of the Palaeozoic, Mesozoic and Tertiary in the Europe and in the North America and elsewhere. And the *Palaeodasycladus* and *Conipora* which are supposed to be the ancestors of the living *Dasycladus* have been traced in the Jurassic. On the other hand, the palaeogeologists have proved that the Tethys Sea had linked the Pacific- and the Atlantic-Oceans during the long geological periods.

It is suggested that the *Dasycladus* or its closest allied forms might be widely distributed on the coasts along the Tethys Sea, and after the great catastrophs of the Tertiary they would have remained the isolated habitats of now-a-days.

121. On the sexual reproduction of *C ulerpa.* (A preliminary report) Seibin ARASAKI and Koji NOZAWA (Bot. Mag. **63**, 223, 1950.)

The sexual reproduction of *Caulerpa brachypes* and *C. Okamurai* take place in the conjugation of biciliated gametes. In the former species, the plant is dioecious, and the gametes are aniso-gamous. The gametes come together making the so-called "Gruppen Bildung" in the conjugating time. The zygotes set in germination after a pause of some intervals.

In *C. Okamurai*, the plant is monoecious, and the gametes are anisogamous.

122. On the life-history of the *Ulva conglobata* KJELLM. (A preliminary note) Kazue FUJIYAMA (Bot. Mag. **63**, 222, 1950.)

Ulva conglobata is identified with *U. pertusa* by the following morphological points; the frond is caespitose expanding in almost circular mass, the colour is bright green, and the inner transparent layer in cross-section is rather thin. In the neighbourhood of the Misaki Marine Biological Station, University of Tokyo, the alga grows abundantly in May through November, especially in summer.

The formation and liberation of the swarmers are found from July to December. Their liberation is usually found in the early morning on the 4-5 days after each spring-tide and continue for about 3 days. The swarmers are elongated pear-shaped, and they have two cilia at the anterior and a chroloplast and an eye-spot in the posterior part. The sexual swarmers appear in the earlier period (July-September) and the asexual ones later (August-December). The sexual swarmers are iso-gamous, about $5\text{-}10\,\mu \times 2.5\text{-}4\,\mu$ (dia. $3\text{-}5\,\mu$) in size, they swim possitive phototactically, and after conjugation the zygotes go to the darker part. The zoospores are about $5\text{-}12\,\mu \times 3.2\text{-}5.0\,\mu$ (dia. $5\text{-}6\,\mu$) in size and show negative-phototaxis. It is impossible to distinguish the sexual swarmer from the asexual one morphologically. The zygotes and zoospores begin to germinate immediately and develop into the young thalli. The parthenogenetical development of the gametes was also observed.

123. Phytoplankton and its oxidisability by permanganate. Yoshiyuki MATSUE (Bull. Jap. Soc. Sci. Fish. **15**, 813-817, 1950.)

The oxidisability of a marine plankton diatom, *Skeletonema costatum*, in culture was determined by potassium-permanganate and was found the value to be excisely proportional to the diatom amount. When the phytoplankton quantities are denoted in W.B.U. (Warm Brown Units*) the following relation can be established.

$$W.B.U. = 1.3 \times O_2 \text{ Cons. mg/1}$$

The result shows that the oxidisability of the phytoplankton of minute size such as *Skeletonema* could be determined as one of its available quantitative indexes. But, it must be pointed out that the above relation does not stand true always; few exceptions are found in some special occasions. For instance, when a nutrient salt such as nitrate or phosphate has become defficient in the medium, though *Skeletonema* growth stops at once in W.B.U. and also in cell numbers, its carbon assimilation alone

* Through culture experiments on *Skeletonema*, Warm Brown Units have been used by the author as a quantitative index of the diatom. It is a quantity to be determined through both the colour and the turbidity of the diatom growing media in its living state, and it has the following relations against to some other diatom units.

$$W.B.U. = 1.6 \times 10^{-8} \text{ Number of cells/1}$$
$$W.B.U. = 4.7 \times \text{Units of pigment/cc}$$

is continued actively for a while, and as the result of it the oxidisability of the diatom reaches to an extraordinary high values.

A similar phenomenon is observed also in culture exposed to too strong light intensities.

As is obvious from the fact, the permanganate method should be rejected for the quantitative determinations of phytoplankton in an experiment such as the physiological analysis of sea water.

To know how much portions of the organic substances assimilated in the diatom cells would be dssolved into the surrounding water, the oxidisability was determined of the media, from which growing diatoms were separated. It was proved by this experiment, almost nothing of the oxidisable matter to be dissolved out from the living cells, throughout its growing course from inoculation to heavy growth.

124. Variations of the titratable base in sea water due to growth of diatom. Yoshiyuki MATSUE (Journ. Oceanogr. Soc. Jap. **6**, 32-37, 1950.)

By culture experiments with a marine plankton diatom, *Skeletonema costatum*, it is found that the titratable base of sea water would be changed in relation to the diatom growth.

In the ordinary culture medium prepared from the sea water and enriched with nitrate, the value of titratable base increases as the diatom growth progresses in the soluton, while in the medium to which ammonium was added in place of nitrate, the reverse result is observed.

Quantitative determinations show that its variations to the opposite directions in both different media are exactly proportional, with the same ratio, to the growth amount of the diatom in culture solutions. In other words, the normality of nitrogen absorbed into the diatom cells, in the form of either anion (NO_3^-) or cation (NH_4^+) gives so much plus or minus changes upon the titratable base of the surrounding media. Numerically, 140 mg/l of nitrogen corresponds to 0.1 mN equiv./l of titratable base value.

In the ocean, the ratio of titratable base to chlorosity in the sea water is maintained fairly constant and only a small variation of it can be observed practically. The variation is generally considered to be brought about by the calcium content of sea water, which may most easily be changed by its cycle through many organisms in the sea. Standing upon such assumption, variations of the calcium content in sea water is often calculated indirectly from ratios of titratable base to chlorosity in sea water.

The results of the experiments shows, however, that such indirect calculation of calcium might have a considerable error in its results, which should be induced by the phytoplankton growth or its decomposition in the sea.

125. Investigations on the origin of the shellfish poisons. (A preliminary report) Yoshiyuki MATSUE (Journ. Fish. Res. Inst., **3**, 31-33, 1950.)

On what grounds some important Japanese shellfish (*Ostraea* and *Venerupis* become poisonous, at the restricted areas and in the definite seasons? The question has not as yet been answered.

Investigatons concerning the problem have been carried out by the author, and experiments are still now being continued. The results obtained are as follows:

(1) All the culture experiments of bivalves, which were planned and have been done until now in order to ascertain a presumption that their poisons might be pro-

duced in the animal body as any abnormal metabolic products, gave altogether negative results. In the experiments, various unfavorable environmental conditions, considered to be as characteristic at the poison districts were provided in the laboratory, and under those conditions the test animals were kept for about 10 days.

(2) From a series of other experiments, a remarkable function of bivalves was found that bivalves kept in the sea water containing strychnine sulphate very little absorb the poisonous substance and accumulate it rapidly in their liver (digestive diberticulum) in short time.

The accumulating power of strychnine was found to be unequal among those species of bivalves, *Venerupis*, *Ostraea* and *Meretrix*. The unequalities coincide with the differences in poison strength which are found among each bivalve species at the poison districts. These results are enough to make us consider the possibility that the origins of the shellfish poisons might exist in the sea water surrounding the animals.

Other organic poisons such as tetrodotoxin or potassium cyanate were proved not to be accumulated by the animals.

(3) Observations during the culture experiments teach us that the colour, the size and the brittleness of the bivalve liver, would be changed depending upon both the quality and quantity of food which the animal has fed on.

Up to the present time, the macroscopic appearances of the liver of the poisonous bivalves have been examined with special interests by several investigators in order to find out any characteristic points in the organ. But, it seems that the features of the organ have no direct relations to its poison content.

126. Silicon in the water. (2) Colorimetric determination of silicon in sea water. Aritsune SAEKI (Journ. Oceanogr. Soc. Jap. 6, 39-43, 1950.)

Experiments on the colorimetric estimation of silicon by DIÉNERT's method were made in the sea water with or without the dilute water-glass solution containing known amount of silicon. "Heat method" (heated the sample water before colorimetry is performed) and "alkali method" (heated the sample water with alkali) were studied, and it was concluded that these methods do not give the satisfactory results. The colorimetrically estimated value of silicon in the sea water shows the decrease or increase in the time of storage. This phenomenon is not caused by the contamination from the glass ware, but caused by the change of silicate form in the sample water. Consequently its value becomes constant after about half a month storage. The colorimetrically estimated value of the sea water stored with sulphuric acid differs from that of without any preservative. In this experiment 0.5cc 6 N sulphuric acid is added to each 100cc sample and when the colorimetry is carried out the molybdate reagent is added to complete the reaction. This procedure prevents the contamination from the glass bottle and the absorption or solvation of silicon from the organic or inorganic particles in the sample water. As the results of these detailed studies of the method, the following precautions and procedures are necessary in the application of the method:

(1) Analysis should be performed after half a month since sampled.
(2) To correct the salt effect the factor "1.25" should be used as WATTENBERG or ROBINSON showed.
(3) To determine the ionic silicon content of the sea water at the bottled time, the sample water should be preserved with sulphulic acid.

127. Silicon in the water. (3) Variaton of silicon values estimated by the colorimetric method in the fresh water and its mixed solution with the sea water. Aritsune SAEKI (Journ. Oceanogr. Soc. Jap. 6, 44-47, 1950.)

It was observed that the colorimetrically estimated values of silicon in the water showed considerable changes by the age of the water.

In the dilute water-glass solution which contains 5.00 mg/1 SiO_2, the values of silicon estimated by the colorimetry show 3.75-6.00 mg/1 at the beginning of its preparation, but show 5.40-6.00 mg/1 after a week. The similar phenomenon is observed in the natural land water. In the water of the Tama River, for instance, by the colorimetry about 80% of the silicon determined by the gravimetry are estimated at the upper stream, but above 100% of them are estimated at the lower.

When the water-glass solution are alkaline in reaction, the colorimetry gives the equal or more (100-130%) slicon values compared to those by the gravimetry, but when the solutions are acidic it gives the equal or less (60-100%) values.

The colorimetric values of silicon in the mixture of the fresh water with the sea water show higher than those calculated from each value before mixing, when the colorimetric silicon values in the fresh water don't reach 80% of the gravimetric values. But, the values after mixing show less than those, when the colorimetric values are above 100% of the gravimetric ones.

These facts show that the colorimetric values of silicon in the water would alter as the results of the transformation of the silicon form in it, and that when the land water is mixed with the sea water, silicon in it changes its form though neither sedimentation is formed nor turbidity is produced.

128. Chemical studies on the shellfish poisons. Yoshiro HASHIMOTO and Takajiro MORI (Journ. Fish. Res. Inst. 3, 34-37, 1951.)

It was confirmed that the paralytic shellfish poison occurred also in Japan. *Venerupis semidecussata* from the Yagyu River in Toyohashi City was proved to be poisonous in summer. The poison resembles to the mussel poison found in California in its chemical and pharmacological properties.

The alcohols acidulated with hydrochloric acid, which have been recommended as suitable solvents by American workers, were proved to produce secondarily a muscarine-like poison even from the non-poisonous shellfish. A mother substance was confirmed to be betaine, which becomes toxic betain alkylester by the treatment.

Venerupin is another poison found in *Venerupis* and was named by AKIBA. The dialysis of liver extract of poisonous *Venerupis* showed that most part of the poison is easily dialyzable, but a small part of it is not dialyzed even after dialysing for a long period. The latter may exist in combined state with high molecular substance.

129. Studies on the nutritive values of algae. (2) Nutritive values of alginic and mannuronic acids. Fumio MATSUURA, Shigeru KARASAWA and Takajiro MORI (Journ. Jap. Soc. Food and Nutr. 4, 21-24, 1951.)

The nutritive values of alginic acid and its component, mannuronic acid, were estimated with rats. The rats were primarily fed on the basal diet until their body weight showed no increase, consisting of horse meat protein 1.08g, butter 2.8g, McCollum salts 0.12g, dried yeast 0.2g and liver oil 1 drop for a rat per day. Then, 1.25g test carbohydrates were added to the basal diet, respectively. The average increase of rat body weight observed in 40 days were as follows: Ca-mannuronate 26.5, alginic acid 5.8, Ca-gluconate 42.9, glucose 56.6 and starch 55.8g.

Alginic acid was confirmed to be none or a very little if any, utililized by rats as energy source. Mannuronic acid, however, showed some nutritive value, but was inferior to the other carbohydrates tested, such as starch, glucose and gluconic acid.

130. Properties of fats and oils contained in various parts of a sperm whale body. Takajiro MORI and Masamichi SAIKI (Rept. Whales Res. Inst., **3**, 79-84, 1950.)

Numerous studies have been made since the olden times on the whale oil. However, these studies have chiefly been confined to the oils from whale blubber, bone and head. The studies on chemical natures of the oils from various organs of an animal is not only important for their utilization but also necessary from the point of fat metabolism.

According to these studies on the sperm whale, considerable differences were found in the different fats of a body.

(1) The average molecular weight of fatty acids in head oil was the smallest, and next blubber oil and followed by large intestine, small intestine and liver oils.

(2) The degree of unsaturation of mixed fatty acids in head oil (I.V. 56.44) was the smallest, and those from blubber (I.V. 80.57), large intestine (I.V. 81.85) and small intestine (I.V. 79.54) were about the same.

(3) The amount of unsaponifiable matter in head oil (45.21%) and blubber oil (35.51%) was exceedingly large, but that from large, small intestines (19.18%, 17.35%) and liver oil (19.01%) was only one-half of the former.

(4) The average molecular weight of fatty acids and the amount of unsaponifiable matter were in an inverse ratio.

(5) The degree of unsaturation of the unsaponifiable matter was smallest in head oil (I.V. 39.08), followed by large intestine oil (I.V. 50.53) and small intestine oil (I.V. 51.72), which were about the same, and largest in blubber oil (I.V. 71.74).

VI. Forestry

Abstracts Nos. 131—191

131. Studies on birch-wood-rotting fungus, *Fuscoporia obliqua* (PERS.) AOSHIMA comb. nov. Kiyowo AOSHIMA (Bull. Tokyo Univ. Forests **39**, 185-207, 1951.)

The morphological, physiological and pathological studies on the wood-rotting fungus of birch trees, formerly called sterile *Fomes* or cankerlike body in Europe, North America and Siberia, have been carried out and the following results are obtained.

(1) The birch fungus is widely found in the subarctic forests in Japan, causing serious damages to the heart-woods of various birch trees.

(2) The fruiting bodies under the bark of the prostrate birch woods (*Betula* spp.) heavily destroyed by this fungus are found. They were produced in these experiments on the agar media. These materials were examined and morphological comparisons were made with those in Europe, the United States of America and Canada.

(3) Cultural studies were made on the six culture-strains obtained from various

localities in Japan and two culture-strains isolated in Canada. As the results of these experiments and observations, it was proved that the Japanese birch fungus was completely same with that in Canada.

(4) Although it is impossible to determine the scientific name of this birch fungus without examining the type specimen, the specific name "obliqua" was given to this fungus. Furthermore, this fungus was ascertained to call under the name of *Fuscoporia obliqua* (PERS.) AOSHIMA, comb. nov., following to the CUNNINGHAM'S systems in classifying the *Poria*, following to the American traditions.

(5) This birch fungus has grown most vigorously on Kôji-extracts agar, malt-extracts agar and on potato-dextrose agar. The synthetic agar media were not favourable for this fungus except WAKSMAN's and CURRIE's agar media.

(6) BAVENDAMM'S reactions of this fungus were tested, which proved it positive in media containing both tannic and gallic acid.

(7) Durability-tests were made on the woods of coniferous and broad-leaved trees. It is shown that this fungus destroys most rapidly the sap-woods of birch trees, but on the contrary heart-woods of conifers are extremely durable to this fungus.

132. On the germination of Hazenoki (*Rhus succedanea* L.) seeds treated with sulphuric acid. I. Ken-ichi HATANO (Journ. Jap. Forestry Soc. **32**, 185-188, 1950.)

Although the external factors (water, temperature, oxygen and light in some cases) are suitable for a seed to germinate, some tree seeds remain dormant because of hard coverings. The seeds of *Rhus succedanea* have also hard endocarps, and ordinarily conc. sulphuric acid are used for their destruction. It was made clear that the endocarps are destroyed by sulphuric acid, and acid-treated seeds absorb more water than the control. The permeability of endocarp to sulphuric acid at different concentration was tested by a new apparatus.

133. On the germination of Hazenoki (*Rhus succedanea* L.) seeds treated with sulphuric acid. II. Ken-ichi HATANO (Journ. Jap. Forestry Soc. **33**, 218-221, 1951.)

It was ascertained that optimum time for immersing in conc. sulphuric acid is 1 to 4 hrs. for the germination of seeds of *Rhus succedanea*, and then that after it was recognized by a new apparatus, that sulphuric acid permeated the endocarps, a long time is necessary until the seeds are injured.

134. Dendrological and wood anatomical notes on *Yukunoki* (*Cladrastis shikokiana* MAKINO) and *Fujiki* (*Platyosprion Platycarpus* MAXIMOWICZ). Taizô INOKUMA and Ken SHIMAJI (Bull. Tokyo Univ. Forests **38**, 125-138, 1950.)

Five known tree species of genus *Cladrastis* including *Platyosprion* were enumerated and their distribution in North America, Japan and China were studied. And a precise distribution map of *Yukunoki* and *Fujiki* in Japan Isles was made.

Dendrological comparison is made between *Yukunoki* and *Fujiki*, especially on the characters of their winter buds and number of vascular bundle scars on a leaf scar. Having studied on the process of development of wood ray type with age after KRIBS' classification of ray types, *Fujiki* is said to have more primitive ray type as compared with *Yukunoki*. Wood anatomical descriptions are made on *Yukunoki* and *Fujiki*. Vessel arrangements of *Yukunoki* and American and Chinese Yellow wood and diffuse porous, while that of *Fujiki* is ring porous. Dendrological and wood anatomical examinations on both species reached to the conclusion that *Fujiki* represents the monotypic genus *Platyosprion* while *Yukunoki* and three American and Chinese species genus *Cladrastis*.

135. An attempt to the rational elucidation of social plant-life; Hydrature and *Abies-Picea* climax in Japan. II. Seasonal change of osmotic pressure of cell-sap of dominant trees in coniferous forest. Ryosuke KATO (Journ. Jap. Forestry Soc. **33**, 215-218, 1951.)

At the arboretum of the Tokyo University Forest in Hokkaido, the osmotic pressure of cell-sap of the leaves of the dominant species (*Abies sachalinensis* FR. SCHM., *Picea jezoensis* CARR., *Picea Glehnii* MAST.) in coniferous forest which are able to find in forest vegetation of the University Forest was measured periodically from Aug. 1949 to Aug. 1950 and showed graphically.

The seasonal change of the osmotic pressure seems to have an important relationship with that of temperature in climatic factors, and especially 5°C and 0°C of air temperature seems to play a very important role upon the seasonal change of the osmotic pressure of these coniferous trees. Judging from the seasonal curve, the form of seasonal change of the osmotic pressure of three dominant species is divided into two types. One is "*Abies*-type" (*Abies sachalinensis*) and the other is "*Picea*-type" (*Picea jezoensis* and *P. Glehnii*). The former exhibited the maximum osmotic pressure (35 Atm.) in January, but on the contrary, the latter did not show such a high maximum and held out nearly the constant osmotic pressure (28-30 Atm.) from November to March.

From the correlation between winter hardiness and osmotic pressure by GOVOROV (MAXIMOV 1929) and WALTER (1931), it is concluded that the species of "*Picea*-type" are hardier for frost than that of "*Abies*--type". Which is hardier for frost among the two species of "*Picea*--type", however, must be left for future study.

136. The forest plants of Prefecture Niigata and its silvicultural consideration. Satoru KURATA and Kozo FUNABIKI (Bull. Niigata Coll. Agr. and Forestry 132-139, 1951.)

It is noticed that the flora of Niigata Prefecture contains many plants characteristic of the Japan Sea side, which cannot be found at the Pacific side of central Honshû. They are classified into three groups on the basis of their distribution. The following results are obtained in the study of ligneous plants used as examples. The first group is of pure Japan Sea elements which are geographically restricted to the Japan Sea side of Honshû where snowfall in winter is very heavy. The marked members of this group are *Torreya ascendens, Alnus Fauriei, Hamamelis obtusata, Sorbus Wilfordii* (it is difficult to distinguish *S. chionophylla* from this species), *Rubus vernus, Lespedeza patens, Ilex leuchoclada, Berchemia longiracemosa* (probably, it is proper to regard this as a variety of *B. pauciflora*), *Camellia rusticana, Rhododendron nipponicum, Rhododendron nudipes, Rhododendron trinerve* etc.

The second group is composed of those species which are widely found in Hokkaidô and the Tôhoku District of Honshû, but in central Honshû confined to the Japan Sea side. *Cephalotaxus nana, Daphniphyllum humile. Ilex readicans, Aucuba japonica* var *borealis, Rhododendron Albrechtii* etc. are good examples.

The third group, on the contrary to the second, is consisted of those species which, being restricted to the Japan Sea side in central Honshû, are widely found in the western Japan. *Alnus pendula, Tripterygium Wilfordii, Frangula crenata, Weigela hortensis* etc. belong to this group.

On the other hand, as the plants characteristic of the Pacific side of central Honshû, it is recognized, there are *Picea polita, Betula Schmidtii, Deutzia Sieboldii*,

Stewartia monadelpha, Rhododendron dilatatum, Fraxinus commemoralis and many others. As forest industry of this snowy district depends chiefly on the natural beech forest and poor coppice forest or bush, the natural reproduction of beech forest, the increase of *Cryptomeria* and other useful conifers, and the improvement of tree species in coppice forest: such problems seem to be most significant.

137. Studies on the vegetation of Chichibu mountain forest. I. The plant communities of the subalpine and alpine zones. Teizo MAEDA and Yoshio SHIMAZAKI (Bull. Tokyo Univ. Forests 39, 171-184, 1951.)

The outcome of the vegetational survey in the whole area of Chichibu mountains performed from 1948 to 1949 is presented in this report.

Nearly all the surveyed area are forests of the subalpine and temperate montane zones, and only four peaks-Kinbu (2596m), Hoppo-Senjo (2600m), Kokushi (2591m) and Asahi (2581m)-attain to the alpine zone. They are altitudinally divided as follows:—The alpine zone: above 2500m; the subalpine zone: 2500m-1600m (*Tsuga diversifolia* zone: below 2000m, *Abies Veitchii-A. Mariesii* zone: above 2000m; the temperate montane zone: below 1600m, and the lower limit of temperate montane zone is obscure, since its lower parts are disturbed by human work.

Plant communities of the subalpine and alpine zones are as follows:

A. Subalpine zone
- a. *Tsuga diversifolia* zone
  1. *Abies homolepis*-consociation
  2. *Larix Kaempferi*-consociation
  3. *Picea bicolor*-consociation
  4. *Thuja Standishii-Pinus pentaphylla-Rhododendron Degronianum f. spontaneum*-consociation
  5. *Tsuga diversifolia-Rumohra mutica*-association
     - *Sasamorpha purpurascens*-subassociation
     - *Sasa nipponica*-subassociaton
     - *Maianthemum dilatatum* var. *nipponicum*-subassociation
- b. *Abies Veitchii-A. Mariesii* zone
  6. *Abies Veitchii-A. Mariesii*-association
     - *Abies Veitchii-Vaccinium Usunoki*-subassociation
     - *A. Mariesii-Pogonatium*-subassociation

B. Alpine zone
  7. *Pinus pumila-Vaccinium Vitis-Idaea* var. *minus*-association
     - *Rhododendron chrysanthum-Cladonia alpestris*-subassociation
     - *R. Fauriae* var. *rufescens-Pleurozium Schreberi*-subassociation

138. On the relation between fiber length of some *Dicotyledonous* woods and the tension wrought on the cambium. Ken SHIMAJI (Journ. Jap. Forestry Soc. 32, 371-372, 1950.)

Reexaminations of SANIO's 1 st law were made on the wood-fiber of *Yukunoki* (*Cladrastis shikokiana* MAKINO), *Fujiki* (*Platyosprion platycarpum* MAXIMOWICZ), *Inubuna* (*Fagus japonica* MAXIMOWICZ) and *Buna* (*Fagus crenata* BLUME). From these examinations some considerations were had on the factors causing such variation of fiber-length, and it was proposed that the tension wrought on the cambium may be the limitting factor at least for certain period in the whole life of a tree.

139. The forest vegetation of Izu peninsula. Tokio SUZUKI and Kinzi HATIYA (Bull. Tokyo Univ. Forests 39, 145-169, 1951.)

The following associations are recognized by the association tables and vegetation maps in this study.

The warm temperate or broad-leaved evergreen climax:—

Machilus Thunbergii-Rumohra aristata association
Shiia Sieboldi-Bladhia japonica association
Cyclobalanopsis stenophylla-Sakakia ochnacea association
Ecotone
Abies firma-Illicium anisatum association

The cool-temperate or deciduous climax:—

Fagus crenata-Sasamorpha purpurascens association

Edaphic climax:—

Quercus phylliraeoides-Pittosporum Tobira association

Seven vegetation types, relating to each of the above association, will successfully put in order the chaos of intermingling vegetation units constituting the warm-temperate climaxes in Far East with neighbouring formations included; namely *Maqui-*, *Machilus-*, *Shiia-*, *Cyclobalanopsis-*, *Tsuga-*, and *Fagus-*.

140. The characteristics of the soil in the east asiatic warm-temperate forest climax. Tokio SUZUKI and Kinji HATIYA (Bot. Mag. Tokyo **64**, 87-92, 1951.)

The temperate region of Japanese Archipelago, both the warm- and the cold-, is comprized in the zone of brown forest-soil. From the vegetational survey in Izu Peninsula, where all the vegetation types of temperate East Asia are represented vertically, the soil types under the warm-temperate climax are found quite different from those under the cool-temperate at least in pH-inclination. In the formers, the surface horrizons have higher pH-values compared with the underlying horrizons, while in the latters the state is converse as in the case of the brown forest soil in general.

141. Contributions to the Japanese fungous flora.. II. Toshio TERAMOTO (Bull. Tokyo Univ. Forests **39**, 209-218, 1951.)

The descriptions of eight species of *Polyporaceae*, which have not been much studied, are presented in this paper.

Coltricia Greenii (BERK.) IMAZ., which has been found only a few times in Japan, is very characteristic by its central stem, concentrical gills, and habitat. It must be put in *Coltricia* according to IMAZEKI's opinion.

Grifola albicans IMAZ. causes a spongy butt rot of the heartwood of living frondose trees. It differs from *G. frondosa* by the whitish uppersurface and the hyphae of context.

Hirschioporus laricinus (KARST.) TEEAMOTO, comb. nov., which has the general aspect of *H. fusco-violaceus*, causes a white pocket rot in softwood. *Lenzites abietis* was named by LLOYD based on the specimen collected in Colorado. But as the same species had already been named *Lenzites laricina* by KARSTEN in Siberia, it is desirable to give the new combination.

Microporus nipponicus (YASUDA) IMAZ. causes a white rot in hardwood. Its occurrence is restricted to Japan.

Piptoporus quercinus (SCHRAD. ex FR.) PILAT, which has been found only in a few times in the world, was collected only twice. It causes a brown cubical rot of frondose wood.

Trametes heteromorpha (FR.) LLOYD is very closely related to *T. albida*. The

former differs from the latter chiefly in its ungulate pileus and its radially furrowed and roughened upper surface.

Tyromyces borealis (FR.) IMAZ. causes the heart rot in living conifers. As to the genus of this species, though it belongs naturally to *Polyporus* in FRIES' system, there are different opinions among the renovational mycologists.

Tyromyces guttulatus (PECK apud SACC.) MURR, can be easily separated from the other species of genus *Tyromyces* by its large and thin pileus, and its rounded spots of the upper surface.

142. A method of estimating intensity of effective radiation using paper evaporimeter. Yoshio ENOMOTO (Journ. Jap. Forestry Soc. **33**, 10-11, 1951.)

A pair of HIRATA's filter paper evaporimers, consisted of one black and one white, are utilized as the instrument.

The difference between evaporation from the black and the white, is indicated as a relative measure of effective radiation.

The empirical formula is shown as follows: $Y=119.815+20.557X$, where Y is integrated intensity of radiation in g-cal/cm^2 and X is the difference of evaporation in gram.

143. Water absorption by tree seeds. Masasi GOO (Bull. Tokyo Univ. Forests **39**, 55-60, 1951.)

A quantitative study of the course of water absorption by seeds of *Cryptomeria japonica* D. DON., *Pinus densiflora* S. et Z., and *Pinus Thunbergii* PARL. during germination was made. The amount of water absorbed by seed was measured by weight increase of seed with the aid of torsion balance at every 24 hours. The increased weight of seed is expressed in term of ration of absorbed water to the original weight of seed. This investigation indicated that the curves of water absorption may be divided into three parts: (1) quick rise during one or two days after set on seed-bed, (2) slow or nearly no rise and (3) second quick rise.

144. Induced tetraploidy in Japanese cypress (*Chamaecyparis obtusa* ENDL.) Rinsuke KANEZAWA (Bull. Tokyo Univ. Forests **39**, 21-30, 1951.)

Cytological studies on the tetraploid Japanese cypress (*Chamaecyparis obtusa* ENDL.), which were induced by 0.3% colchicine treatments of seeds in 1942, were made. By the study of nuclear divisions in the shoot- and root-tips, the chromosome numbers were determined to be $2n=22$ for the diploid and $2n=44$ for the treated plant; thus the writer has confirmed the fact of chromosome doubling. In comparison with the diploids, the characteristics of the tetraploid *Chamaecyparis obtusa* are as follows:

(a) Number of needles per unit length of branch is greater.
(b) Number of stomata per square milimeter is ¾ of diploid ones.
(c) Stomata size is 30% greater than that of diploid in the average diameter.
(d) Both radial and lateral diameters of cells are larger, 4.86% longer in average; and the size of cells in the transverse sections is greater than that of the diploids, and rounder in shape.

145. Water intake by cuttings of Sugi. Taisitiroo SATOO (Journ. Jap. Forestry Soc. **32**, 287-292, 1950.)

It is well known that cuttings of sugi (*Cryptomeria japonica* D. DON) sometimes survive considerably long without rooting. Of these cuttings without roots, some form callus tissues on the cut surface, others show no responses apparently. Some authors have presumed that the formation of callus tissue results an increase of the

water intake by cuttings, but no experimental data have been obtained. To make clear these presumptions, some experiments were carried out. Rooted cuttings transpired much more than those without roots, among which callused ones showed slightly higher rates of transpiration as compared with those without callus. The differences between them were statistically significant, but difference between the two types of unrooted cuttings may be negligible in the practice of cuttings. The transpiration rate of rooted cuttings increased day by day, probably due to the growth of the roots. Entrance of water into unrooted cuttings with callus tissue was traced by means of colored solutions. The occurrence of dye was taken as an evidence of entrance of water. Microscopic examination showed that the path of dye could be traced to gap of callus tissues and wounds.

146. Leaf temperature in relation to the influence of wind on transpiration of plants. I. Taisitiroo SATOO (Bull. Tokyo Univ. Forests 39, 31-38, 1951.)

Transpiration rates of cut shoots of *Cryptomeria japonica* and *Quercus myrsinaefolia* increased with rising temperature of water supplied. The rate was increased by wind when water nearly frozen was supplied, while it was decreased by wind when water temperature was 10°C or higher, and the decrease of the rates by wind grew more remarkable with rising of water temperature. The higher the temperature of water supplied was the higher the temperature of leaves and needles. When exposed to wind, leaves and needles were cooled nearly to the air temperature, so cooling of leaves and needles by wind was more remarkable when water temperature was higher. From the fact, it may be said that the influence of wind on transpiration is modified by the temperature of leaves and needles, and it may be reasonable to presume as follows: cooling of leaves and needles by wind results the lowering of the vapor pressure gradient between transpiring surface and the atmosphere and lowest transpiration; on the other hand wind removes the layer of water vapor on transpiring surface and accelerate transportation; thus the combination of the two opposite sides of the effect of wind was observed on transpiration as the result.

147. Leaf temperature in relation to the influence of wind on transpiration of plant. II. Taisitiroo SATOO (Bull. Tokyo Univ. Forests 39, 39-47, 1951.)

Effect of the temperature of leaves and needles on the influence of wind on transpiration was studied by using cut shoots of *Cryptomeria japonica*, *Lithocarpus edulis*, *Shiia Sieboldi*, and *Cinnamomum Camphora* as materials. The temperature of leaves and needles of those illuminated directly by an electric lamp was higher than that of those exposed to light filtered by a layer of water, and they were both higher than the air temperature. When exposed to an artificial wind, the difference between them was eliminated and they became nearly equal to the air temperature. In the calm air conditions, the rate of transpiration of the former was higher than the latter. When exposed to wind, the rate of all four species under the direct light decreased remarkably, while that of those under the filtered light showed no constant trend, i.e., in *Cr. japonica* it increased, in *C. Camphora* it showed no significant change, and in *L. edulis* and *Sh. Sieboldi* it decreased. However, in the species which transpiration rate under the direct light decreased remarkably by wind, the rate also decreased by wind under filtered light; and in those the transpiration rate decreased by wind relatively little in the former case, where as the rate increased or showed no change by wind in the latter case. In most cases, the difference in the rate of transpiration due to the kind of light was eliminated by wind. The water content

of leaves and needles showed no significant differences between them. Stomata seemed to be closed or nearly closed, except *Cr. japonica* which test of stomatal aperture was impossible. The results shown above substantiates the conclusion of the previous report that the influence of wind on transpiration is modified by the temperature of leaves and needles. A discussion of the possible explanation for the observed facts is given.

148. Leaf temperature in relation to the influence of wind on transpiration of plants. III. Taisitiroo SATOO (Bull. Tokyo Univ. Forests **39**, 49-54, 1951.)

An influence of wind on the transpiration of new and old leaves of *Lithocarpus edulis* was studied under various kinds of light, in order to ascertain the conclusion of the previous report. In calm air, the transpiration rate was highest in those exposed to a 500 watt bulb directly and the lowest in those under a 100 watt bulb without filter. When exposed to wind, the rate of those applied with a 500 watt bulb with a layer of water as a long wave filter increased, while the rate of those under the direct light of under the 500 and 100 watt bulbs decreased. When the rate was increased by wind, the increase was more remarkable in the new leaves, and when it decreased, the decrease was more remarkable in the old ones. Differences in the transpiration rate of those exposed to the 500 watt bulbs, which was observed in calm air conditions, was eliminated by wind, both for new and old leaves. The leaf temperature was highest in those exposed directly to the 500 watt bulb and the lowest in those exposed to the 500 watt bulb with filter; it was higher in old leaves than in new ones and all higher than the air temperature. When exposed to wind, leaves were cooled nearly to the air temperature. The results shown above substantiate the conclusion of the previous reports that the influence of wind on the transpiration of plants is modified by the leaf temperature.

149. Obtaining rooted cuttings from a mature *Kiri* tree (*Paulownia tomentosa* STEUD.). Ryookiti TODA (Journ. Jap. Forestry Soc. **32**, 241-243, 1950.)

STOUTEMYER'S (1937) method of obtaining rooted cuttings from mature trees, which ordinary shoots do not root (RS-cutting method), was applied with success as a method of propagation of kiri tree (*P. tomentosa*). Out of 14 root cuttings 10 rooted and remaining 4 gave 8 shoots, from which 20 leaf-buds and 6 shoot tips were collected. Nearly all of these cutting successfully rooted while the cuttings collected directly from trees all failed to root. Cuttings collected from shoots developed on stem cuttings also rooted but in lower percentage.

150. Silvicultural studies on *Kusu* (*Cinnamomum Camphora* SIEB.). **On the heterospermy of seeds.** Sukenaka WATANABE (Bull. Tokyo Univ. Forests **39**, 13-20, 1951.)

As the results of germination test and of after hot water treatment, it was found that it is convenient to classify seeds of *Kusu* into two types for practical standpoint, namely hard type and ordinary type. The seeds of hard type were smaller and darker than those of ordinary type. The seeds of hard type showed lower germination percentage in the case of ordinary seeding, but the hot water treatment increased the percentage as high as that of ordinary type. The hot water treatment was harmful to the seeds of ordinary type. It has been said that the germination percentage decreases when seeds are kept in the room for longer than four months after seed collected. But in our experiment, despite the storage for six months, the germination percentages of ordinary and hard types were 22 and 2 respectively, averaging 11.2%.

Generally speaking, for Kusu nursery practice it is advisable to use the seeds of ordinary type. In case the seeds of hard type are to be used it is desirable to apply the hot water treatment.

151. Fundamental studies on the formation of cutting series. I. On the protection of a stand against storm damages. Taneo HIRATA (Bull. Tokyo Univ. Forests **39**, 1-12, 1951.)

In the case of a form-exponent (by KUNZE) $r<1.\dot{3}$ in an isolated coniferous tree (i.e. full-bodied tree), according to these theories, when m_α (clear-length/height) ranges 0.4, the tree is most dangerous against "Stembreak" by wind pressure; in the other case of $r \leqq 1.3$ (i.e. tapering tree), the more increases the clear-length, the more decreases the wind-firmity, and by the way, "the strongest form-exponent r_0" decreases with m increasing. Against "Blow-down", m_β in the above meaning, ranges 0.3, independent on r. So far as storm damages are concerned, it is theoretically concluded that a stand with complete canopy, composed of comparatively full-bodied trees strongly pruned or tapering, for instance, edge trees in shelter belt, which clear-lengths nearly equal zero are even more resistable against storm damages.

152. Some experiments on a tractor and sleds for hauling logs on snow. Makoto FUJIBAYASHI, Mitsuo HONDA and Sanpei YAMAWAKI (Rept. Govern. Forest Exp. Stat. **60**, 17-29, 1951.)

Results of the field experiments of the tractor hauling on snow performed in January 1950 at Hetonaizawa National Forest in Akita Prefecture are reported. MITSUBISHI Type-25 3-ton crawler tractors and the ordinary wooden sleds were used for the experiments. Adhesion tractive effort of the crawlers and resistance of the sleds were measured by a selfrecording oil-pressure guage mounted on a intermediate sled. Start resistance (statical friction) and running resistance (moving friction) were measured under various conditions of snow ways, of log-carrying sled-runners, of loads and buffer devices. The coefficients of resistance were calculated and the numerical values were analysed, whence some principles governing the motion of a train of sleds pulled by a tractor, and also a load-table for the practical purposes were obtained.

153. Tests on the stump extraction for *Hinoki*. Makoto FUJIBAYASHI, Mitsuo HONDA and Michitaka TSUJI (Forest-Technical Series Govern. Forest Exp. Stat. **8**, 1951.)

Various methods of stump extraction may be classified into (1) extraction with hand-tool, (2) extraction with powered-machine and (3) extraction by explosion. A comparative field-study was perfomed on these methods for *Hinoki* (*Chamaecyparis obtusa* S. et Z.) stumps. The extraction tests were carried out in September through December of 1947 at Meguro, Tokyo. The results of the tests are analysed and the characteristics of the three methods are clarified. A brief summary of comparison is shown in the following table.

Method of extraction		Hand-tool		Powered-machine	Explosion
Name of tool, machine or explosive		“Heebo”	“Kito”	“Niiko”	“Carlit”
Materials required	Main Parts	Small-size winch	Chain-block	Winch, Engine, Gas-producer	
	Attachments	Wire-rope, Chacker	Adjuster, Wire-rope, chacker	Wire-rope, Grips, Chacker	Bar, Borer, Buttery
	Consumptions	——	——	Charcoal, Mobiloil	“Carlit”, Detonators
Initial charge for materials		Tool ¥9,100	Tool ¥20.000	Machine and Wire-rope ¥65.000	22.5 kg “Carlit” ¥2,160 100 Detonators ¥660
Capacity in tons (maximum)		3 (5)	5 (8)	9	——
Diameter of stump in cm		9.7～74.5	13.2～36.0	13.0～32.5	21.0～34.0
Time used per stump in minutes		12.9	35.1	18	15.2
Operators	Labourors	2	3	3	2
	Technicians	——	——	1	1
Operating costs per stump	Wage	¥7.17	¥29.24	¥22.88	¥14.78
	Consumptions	——	——	¥ 5.82	¥50.24

154. A study on the calculation of wire-ropes used for skyline-skidding. Seihei KATO (Bull. Tokyo Univ. Forests **38**, 187-212, 1950.)

Concluding the theoretical analysis and the comparative study of the previous formulas for stresses in cable, following formuias applicable to the determination of dimension, stress and factor of safety of any cable or steel wire-rope used for skyline-skidder in logging practice are given.

(1) Tensile stress in kg/mm^2,

$\sigma_t = \frac{T}{\eta \cdot A} = \frac{T}{A_e}$, where T=Tensin in cable in kg, A=Usefull net cross-sectional area of cable in mm^2, A_e = Effective cross-sectional area, η=Efficiency of cross-sective.

(2) Bending stress in kg/mm^2 due to curvature of winding drum, sheave or pulley,

$\sigma_{b1} = \frac{\delta}{D} \cdot k_1 E$, where δ=Diameter of wire-element in mm, D=Diameter of drum, sheave or puller in mm, E=Modulus of elasticity of wire material in kg/mm^2, k_1=Coefficient, usually 3/8 is reasonable.

(3) Bending stress in kg/mm^2 due to lateral load,

$\sigma_{b2} = P\sqrt{\frac{k_2 \cdot E}{TA}}$, where P=Lateral load in kg, k_2=Cofficient, usually 0.4 is reasonable.

(4) Maximum stress,

$$\sigma_{max1} = \sigma_t + \sigma_{b1} \text{ or } \sigma_{max2} = \sigma_t + \sigma_{b2}$$

(5) Factor of safety for tension only,

$$N_t = \frac{\sigma_{tb}}{\sigma_t}, \text{ where } \sigma_{tb} = \text{Breaking stress of cable in kg/mm}^2$$

(6) Factor of safety for total stress,

$$N = \frac{\sigma_{tb}}{\sigma_{max1}} \quad \text{or} \quad N = \frac{\sigma_{tb}}{\sigma_{max2}}$$

Using these formulas the author compiled three original tables for practical use of calculation in regard to the JIS specified 7×6, 19×6 and 37×6 multiple-stranded and hemp-coréd steel wire-ropes made of three different grade of materials, which are most popular in this country. In addition, the treaties concerns to the compressive stress, which should be taken into account in some cases, and the durability of cable. To presume the durability of cable, namely the allowable limit of cycles in the skidding operation, the author recommends the use of durability-graph prepared by ÄTHERTON or HÄNCHEN.

155. A study on the composite wood-concrete T-beam bridge. Seihei KATO and Yuzo WADA (Bull. Tokyo Univ. Forests **39**, 81-90, 1951.)

The bridge-models used for the bending experiments were built of three T-beams composed of Sugi-timber (*Cryptomeria japonica* D. DON) and cement-concrete. The bending tests were performed with central concentrated loadings. Various preliminary experiments were carried out to determine the most adequate composition of the concrete, the dimension of the beams and the method of building them up to a bridge, before the final tests. The conclusions derived from the results of the expeliment are as follows:

(1) The strength and the flexural rigidity of the composite wood-concrete beam-bridges are considerably higher than those of the wooden beam-bridges of the same size.

(2) The theoretical formulas are practically applicable for the proper design of the wood-concrete beams.

(3) Adequately designed wood-concrete bridge composed of good materials might be safely and economically applied for the practical purposes if they were carefully erected.

156. A study on the maximum gradient of minor forest-railway tracks. Seihei KATO (Bull. Tokyo Univ. Forests **39**, 91-122, 1951.)

In order to make accurate calculation of the maximum gradient of minor forest-railway tracks the factors and the elements related to the gradient such as tractive effort of locomotive caused by adhesion and motive power, types of power transmission, resistance due to velocity, acceleration, grade and curve, brake mechanism and brake force etc. were at first analyzed. And then it was discussed on various previously given formulas and numerical values for the calculation of these factors and elements.

Concluding these analysis and investigation, the use of following formulas for the determination of the maximum gradient of 2′-6″ tracks are recommended.

(1) Maximum gradient with regard to adhesion,

$$s_{2rmax}\ ‰ = \frac{1000 \cdot f \cdot m - [(w_{lL} + w_{kL} + c_L \cdot a) + (w_{Gl} + w_{kG} + c_G \cdot a)n]}{1 + n}$$

in which, f = Coefficient of adhesion in kg/kg = 0.05~0.20 according to the conditions of rail

$$m=\frac{\text{(Effective weight of locomotive for adhesion)}}{\text{(Net weight of locomotive)}}$$

w_{lL}, w_{lG} = Coefficient of running resistance in kg/t of locomotive and that of trolley respectively, estimated preferably for higher class tracks $w_{lL}=7\sim8$, $w_{lG}=5\sim6$, for middle class tracks $w_{lL}=w_{lG}=10\sim12$, for lower class tracks $w_{lL}=w_{lG}=12\sim16$

w_{kL}, w_{kG} = Coefficient of curve resistance in kg/t of locomotive and that of trolley respectively, for which application of PROTOPAPADAKIS' formula

$w_k=\frac{0.50\cdot f(0.76+\sqrt{0.76^2+A^2})}{R}$, where f denotes coefficient of friction in kg/t between rail and wheel, A denotes wheel-base length in m, R denotes radius of curvature in m, is recommended, though it should be modified in some cases

c_L, c_G = Coefficient relating to mass increase of locomotive and that of trolley respectively, when rotating parts are taken into account

a = acceleration in m/sec²

$$n=\frac{\text{(Total weight of trolleys in train)}}{\text{(Weight of locomotive)}}$$

(2) Maximum gradient with regard to engine power,

a) For locomotive with mechanical power transmission arrangement,

$$sz_{max}\ ‰=\frac{1}{1+n}\left[\frac{210N_m}{V\cdot L}-(\Sigma w_L+n\cdot\Sigma w_G)\right]$$

b) For locomotive with electric power transmission arrangement,

$$sz_{max}\ ‰=\frac{1}{1+n}\left[\frac{190N_m}{V\cdot L}-(\Sigma w_L+n\cdot\Sigma w_G)\right]$$

in which, N_m = Motive power of engine in P.S. (metric H.P.)

V = Velocity of train in km/h

w_L, w_G = Coefficients of resistance as mentioned above

L = Weight of locomotive in t

n = Ratio of weight of trolleys to that of locomotive as mentioned above

(3) Maximum gradient with regard to brake force,

$$s_{bmax}\ ‰=\mu kk_1+w_l-\frac{c\cdot V_1^2}{2(L_B-l')3\cdot6^2}$$

in which, μ = Coefficient of friction of brake-block in kg/t

$$k_1=\frac{\text{(Brake force in t)}}{\text{(Weight of vehicle in t)}}$$

$$k=\frac{\text{(Numbers of brake axle)}}{\text{(Total numbers of wheel axle)}}$$

w_l = Coefficient of running resistance in kg/t as mentioned above

c = Coefficient relating to mass increase as mentioned above

V_1=Velocity of train in km/h at the moment when brake operation begins

L_B=Allowable distance in m for reducing train velocity to zero

l'=Distance in m over which train runs during a certain interval of time which should be necessary to make brake force effective after brake operation is started.

157. Construction of an experimental suspension chute in the Tokyo University Forest at Chichibu. Yoshitaro SUMITA and Yoshitaka NARUSE (Bull. Tokyo Univ. Forests **39**, 61-81, 1951.)

This article is a brief report on the construction of a cable suspension chute installed at Akazawa logging site in the Tokyo University Forest at Chichibu in 1949-50. The logging area is situated at the upper part of the University Forest and several kilometers apart from the terminal of the main forest railway track. The site has been planned to be operated during next ten years to yield approximately 100,000 koku of valuable logs of various kinds of hardwoods and conifers from the natural forest. To haul out the logs from this area to the main track terminal, a short stretch of another rail track was constructed in 1949. But, owing to the most steep and rugged topography, it was indeed a difficult task to connect the new track to the main track terminal. The use of a aerial cable way or a chute was the only possible way considered. The authors choose the chute for the experimental purposes to minimize the cost of construction and hauling operation. The main part of the chute installation had to be suspended over a deep valley by wireropes. For the design and construction of this unique structure of the Suspension Chute, several preliminary experiments were carried out at first to determine the coefficients of statical and dynamic friction of logs on the chute, and then performed theoretical analysis in regard to the structural mechanics to determine the vertical curve of the runway and the maximum tension of the cable. The theory of the parabolic cable was applied, and the velocity of the sliding log was theoretically presumed. The chute was erected with success, the logs run along the chuteway with their own gravity. The velocities of the running logs were measured, and proved almost satisfying the theoretically designed relations. The cost of construction was 234,913 yen in total. The experimental hauling operation will be continued hereafter, so that the economical effect of the chute will be examined and reported in future.

158. A study on the run-off controlling effect of forest by means of the statistical method. Yoichi NOGUCHI (Bull. Tokyo Univ. Forests **39**, 135-141, 1951.)

In order to express the run-off controlling effects of forest the following three statistical formulas are presented and compared with each other.

(1) $S_r = \sqrt{\frac{\Sigma d^2}{n}}$

(2) $F_0 = \frac{S_r}{S_p}$

(3) $F_1 = \frac{F_0}{A_r} = \frac{S_r}{S_p A_r}$

where d=Difference between daily run-off and the average run-off during a year

n=Number of days in a year

S_r=Standard deviation of daily run-off

S_p=Standard deviation of daily precipitation
A_r=Average of daily run-off

As the results of the comparison using data of 20 years obtained from the experiments conducted on 4 watersheds in the Tokyo University Forest in Aichi, formula 3 is found to be most suitable for expressing the run-off controlling effect of forest.

159. A study on the erosion control of forest. Yoichi NOGUCHI (Journ. Jap. Forestry Soc. **33**, 132-135, 1951.)

The silt amount is shown, which was dredged out of four reservoirs each equipped with a water gauge in the Tokyo University Forest in Aichi. By examining the conditions of the forest cover of the corresponding four watersheds, the effect of forest on erosion control is pursued. The average depth of eroded soil has been from 0.06mm to 1.10mm during 20 years. The effect of erosion control planting can be seen as a long term tendency illustrated by five years' moving average.

160. Integral method of representing stream flow controlling function of watershed and its application. Sadao OGIHARA (Bull. Tokyo Univ. Forests, **39**, 123-134, 1951.)

For the expression of stream flow controlling function of watershed, it was studied how Dr. SAKURAI's idea (a method similar to calculation of the standard deviation in statistics) develops. Recently it was found by the author that the best method is to use the discharge at every instant, which is called "flow intensity"—an unit having dimention $L^3 T^{-1}$. The calculation of the devision of flow intensities is called "integral method" against the day unit method which would be generally named "step method".

In this article the integral method is applied to the data obtained in the stream gauging experiment conducted in the Tokyo University Forest in Aichi. In comparing the four watersheds each other, it is concluded that the forest is an important factor in increasing stream controlling function.

Further more it was worked out to show the principle and design of a practical apparatus for integral method.

161. Studies on the weight-growth of forest trees. II. *Picea excelsa* LINK of the Chichibu University Forest. Shinji HIRAI (Bull. Tokyo Univ. Forests 38, 139-152, 1950.)

Four sample trees of *Picea excelsa* of 30 years of age were taken from an artificial stand of the Chichibu University Forest in Saitama Prefecture. The distribution of the bulk density, "Raumdichtezahl" by TRENDELENBURG within the stem of each sample was examined, and from this result the weight increments of individuals and that of the stand were calculated. The results of these studies are as follows:

(1) Generally speaking, the more inferior the tree becomes, the heavier the wood is, but a dominant tree does not always have the lightest wood.

(2) The weight-increment of the individual tree runs almost parallel to its volume one, except an instance in which the current annual increment of volume goes down, but that of weight does not so.

(3) The standard bulk densities of the individual tree, which are obtained by dividing the total weight-increment by the volume one, are 304-345 kg/m^3, the mean is 328 kg/m^3.

(4) The total produce per 1 ha of this researched stand amounts to 73,003 kg in weight, 223.24 m^3 in volume, and the average annual produce 2,433 kg in weight and 7.44 m^3 in volume.

162. Studies on the weight-growth of forest trees. III. *Cryptomeria japonica* D. Don of Daigo district, Ibaragi Prefecture. Shinji Hirai (Bull. Tokyo Univ. Forests **39**, 219-234, 1951.)

Four sample trees of *Cryptomeria japonica* (Sugi) of 56 years of age were taken from an artificial stand in Daigo district, Ibaragi Prefecture. The researching method was similar as the preceding report. The results are as follows:

(1) The weight-increments of the samples run almost parallel to their volume one, but the maxmum of the current annual increment of weight comes 5 years later than that of volume in three of four trees. In the case of the only instance which passed the maximum of the average increment, the maximum age coincides as to volume and weight.

(2) The standard bulk densities of the individual trees are 287-374 kg/m^3, and the mean is 322 kg/m^3.

(3) The relation between the stem-class and the weight of its wood is similar as the case of *Picea excelsa* shown in the preceding report.

(4) The total produce per 1 ha of this researched stand amounts to 147,777 kg in weight, 473.45 m^3 in volume and the average annual produce 2,639 kg in weight, 8.45 m^3 in volume. The result is summarized in the following table with that of other species formerly reported by the author.

Species	Locality	Years of age of tree	Average annual produce in weight per 1 ha
Larix leptolepis	Univ. Forest at Yamanaka, Yamanashi Pref.	30	* 1,199 kg
Picea excelsa	Univ. Forest at Chichibu, Saitama Pref.	30	2,433 kg
Cryptomeria japonica	Daigo district, Ibaragi Pref.	56	2,639 kg

* This stand is extremely inferior in growth, for its produce in volume and weight indicates below 1/3 of that of other stand in Hokkaidô.

163. Studies on plywood. VII. Influences of the gripping equipment, the loading velocity and the depth of notch on the testing value of adhesive strength of plywood. Shinji Hirai and Takashi Shimizu (Wood Industry **5**, 85-86, 1950.)

Tests were made on a few factotrs which have influenced on the value of the adhesive strength of plywood and the following results were obtained.

(1) Comparative experiment on the effect of the gripping equipments with and without side guides indicates that there is no difference between the two.

(2) The value of the adhesive strength ascends with the loading velocity which are changed from 100 to 800 kg/min., but within the range from 200 to 600 kg/min., the values are almost equal.

(3) The value of the test piece in which the notch is not reached to the glue line represents about 20% higher than that of the piece in which the notch is accurately reached to the glue line.

164. Studies on hardened fiber-board. III. The effect of moisture content on the Young's modulus and the strength of hardened fiber-board by bending. Kakuichi Kitahara (Wood Industry **5**, 172-174, 1950.)

The tested hardened fiber-board is made of saw dust of "*Sugi*" (*Cryptomeria japonica* D. Don.) with milk casein. The relation between the moisture content u (%) and Young's modulus E is indicated by following experimental formula in bending test.

$$E\ (\times 10^4) = 4.0 - 0.07u\ (kg/cm^2)$$

And the realion between the moisture content u (%) and modulus of rupture is indicated by following experimental formula in bending test.

$$\sigma = 268\ (1 - 0.020u)\ (kg/cm^2)$$

From these results, we have to take care of the decrease of mechanical strength of hardened fiber-board by increasing the moisture content, as same as in wood.

165. Studies on hardened fiber-board. V. Effects of methods of the wire-netting used at preparation on the properties of the hardened fiber-board. Kakuichi Kitahara (Wood Industry **6**, 161-164, 1951.)

Tested properties of the hardened fiber-board are thickness h (cm), water content u (%), specific gravity r in air dry, specific gravity r_0 in oven dry, Young's modulus E, modulus of rupture δ, ratio R (%) of deflection to span l, absorbed energy U in impact bending and Brinell hardness H. In general, No. 9 mesh in U.S.A. type is excellent as shown in the table below.

Mesh	h (cm)	u (%)	r	r_0	E(kg/cm³)	σ(kg/cm³)	R(%)	U(kg-cm/cm³)	H(kg/mm²)
16	0.48	8	0.83	0.58	3.2	272	6	10	2.82
8	0.49	8	0.80	0.57	2.7	257	7	11	3.15
7	0.50	7	0.86	0.58	2.4	240	8	9	2.84
9	0.47	7	0.80	0.60	2.6	282	10	13	3.01
7	0.52	8	0.79	0.56	1.8	195	9	10	2.29

166. On the nail-holding power of hardened fiber-board. Kakuichi Kitahara and Shitomo Mamada (Bull. Tokyo Univ. Forests **39**, 235-250, 1951.)

The main raw material is ground pulp of redpine (*Pinus densiflora* Sieb. et Zucc.). The thickness of the board is 5 mm. The specific gravity is 0.87 in air dry and 0.79 in oven dry. The Brinell hardness is 3.1 (kg/mm²). The water content is 10% in air dry. The results of this test are as follows: (Pmax is the maximum nail-holding power; Pm is the mean value of it; d is the diameter of nail; u is the water content (%)).

(1) $P_{max} = 0.52 + 29.5d$ (kg)

(2) $P_m = 0.15 + 0.61d$ (kg)

(3) On *hinoki* (*Chamaecyparis Obtusa* Endl.) having same dimensions, these formulas are as follows:

$P_{max} = 3.6 + 26.02d$ (kg)

$P_m = -0.12 + 2.23d$ (kg)

The water content is 16% and specific gravity is 0.40 in air dry in this case. The values of Pmax and Pm of *hinoki* are larger than those of the hardened fiber-board, in spite of smaller specific gravity in oven dry. This fact is attributed to the difference of the internal structure between them.

(4) When the water content is controlled before the nail is driven,

Pm=0.374+0.0082u (kg)

The relation between Pmax and u is obscure in this experiment.

(5) When the water content is controlled after the nail is driven,

Pmax=4.5+0.6u (kg)

Pm=0.210+0.031u (kg)

(6) The relation between the diameter d (cm) of nail head and the holding power P is indicated by following formula,

$P=341d^{1.204}$ (kg)

(7) The relation between the margen depth S (mm) and the lateral margin resistance is indicated by following formula,

$Ps=17.3S^{0.6921}$ (kg)

(8) The relation between Ps and u is indicated by following formula,

Ps=6.8−1.04u (kg).

167. Experimental study of the wood bending. Yoshio SAITO, Kakuichi KITAHARA and Kentaro ISHII (Wood Industry **6**, 12-17, 1951.)

Relations between the energies of bending and conditions of softening wood were studied using Buna (*Fagus crenata* BLUME).

The results are as follows:

(1) The energy is smaller by boiling method than by steaming method, but stain is more remarkable by former method.

(2) The energy is smaller in sap wood than in false heart wood.

(3) On the softening time, 10 minutes in boiling method and 15 minutes in steaming method, are enough at these test pieces (10×10 cm in cross section). But too softened test pieces easily break at tension side.

(4) The energy of radial section bending is as same as of tangential section bending.

(5) The softening temperature must be higher than 80°C.

(6) The higher moisture content before the test pieces are being softened is desirable.

168. On the change of amount of combined alkali during viscose-ripening. Tomoichiro NAKATSUKA (Journ. Jap. Forestry Soc. **32**, 279-286, 1950.)

It is a well known fact that the amount of combined alkali of cellulose xanthate decreases during the ripening of viscose. From the results of the determination of combined alkali during ripening, which were obtained by the author's experiments and had been already reported by other investigators, it is recognized that the relation between the time of ripening and decreasing of the amount of combined alkali may be approximately expressed by a simple empirical formula. The empirical formula is as follows:

$$C = C_0 e^{-kt}$$

where t is the time of ripening, C and C_0 are the amount of combined alkali of cellulose xanthate at any time t and $t=0$, respectively, e is the base of natural logarithm, and k is a constant.

169. Moistureproof of wood by the treating with acetic anhydride and zinc chloride. Takashi SHIMIZU (Journ. Jap. Forestry Soc. 32, 408-413, 1950.)

The wood of Hinoki (thickness 1 mm.) was acetylated at 30°C. with acetic anhydride, zinc chloride and acetic acid to decrease its swelling and shrinkage, and the suitable conditions of treating time and additional weight of zinc chloride to 150 cc. of acetic anhydride and 200 cc. of acetic acid were studied. The results are as follows:

(1) The suitable treating conditions are indicated in the following table.

Additional weight of zinc chloride (g)	Treating time (day)
5	3-4
10	2-3
15	2-3
20	2-3
25	1-2

(2) The samples treated with above-mentioned conditions indicate increasing weight of from twenty and several to forty percent, and their effects of moisture-proof are about three times as compared with untreated one.

170. Studies on bamboo. V. Individual differences and variations due to the locality found in physical properties of *Phyllostachys pubescens* MAGEL. Yasushi SUZUKI (Bull. Tokyo Univ. Forests 38, 167-177, 1950.)

Individual variations and differences due to locality in the properties of *Phyllostachys pubescens* MAGEL are studied with 33 culms grown at several localities in Japan. Test results show that:

(1) Marked variations in the properties are recognized among individual culms from the same stand. But the differences in the average density and bending strength due to the locality (strictly speaking, due to the stand) are found to be significant magnitude, being still greater than the individual variations.

(2) The vertical transitions in the density and the bending strength within a culm are of regularlity for the most test culms (Table 1).

Table 1. Vertical transitions in the density and the bending strength within a culm, expressed as average ratios of 20th internode's to 10th internode's.

Property	Density			Bending strength		
Part	Whole	Outer	Inner	Wnole	Outer	Inner
average ratio	1.09	1.00	1.09	1.13	1.02	1.24
Standard deviation	0.053	0.027	0.065	0.092	0.057	0.129

* Height from the ground; about 4 m at 20th internode, about 1.4 m at 10th internode.

171. Studies on Bamboo. VI. Dependences of the mechanical properties of *Phyllostachys pubesces* MAGEL upon the moisture content. Yasushi SUZUKI (Bull. Tokyo Univ. Forests 38, 181-186, 1950.)

The influences of the moisture content on the mechanical properties of Môsôchiku (*Phyllostachys pubescens* MAGEL) are studied. Table 1 shows the dependence of the strengths upon the moisture content which have, generally speaking, the same appearance as that of wood.

Table 1. Mechanical properties in oven dry, air dry and water swollen conditions.

Property	Part		Oven dry	Air dry	Water swollen
Bending strength kg/cm²	Outer		3710	2690	2460
	Inner		1600	1440	1210
Cleavage strength kg/cm	Outer		78	65	57
	Inner		83	59	54
	Whole		58	65	61
Shear strength kg/cm²	Whole		182	114	87
Hardness kg/mm²	Outer	End	9.1	6.3	4.9
		Side	3.7	2.5	2.2
	Inner	End	6.6	3.2	2.7
		Side	3.7	1.7	1.3

The difference of strengths between the air dry and the swollen conditions are, however, relatively small, especially in the bending and cleavage strengths as compared with wood. This tendency seems to characterize the mechanical properties of bamboo.

172. **On the ground substance of free bark.** (Preliminary report) Noriyoshi IIZUKA (Journ. Jap. Forestry Soc. **33**, 7-10, 1951.)

The yields (17-52%) and s.g. (smaller than water) or states in ordinary temperature of tars and appearances of residual charcoals obtained by dry-distillation of outer barks were different from wood-tar and wood charcoal, therefore it was suggested that the ground substances should not be cellulose and differ with one another. The purified outer barks (extracted with alcohol-benzene (1:1) and with water under 120°C) were converted into almost soluble matter by diluted alkali-digestion from which the large quantities of fatty acids (42.82-52.16% on original barks) were obtained. From this result, it is thought that the ground substances of barks were high molecular matter such as spollopolenin, cutin and suberin. The purified outer barks resisted against oxidizing agent (30% H_2O_2 5 cc+gracial acetic acid 64.5 cc). Seeing the above result, it can be said their ground substances must belong to suberin group.

173. **Studies on carbonization of wood (7).** Ihachiro MIURA, Takeo SHIBAMOTO, Osamu SATO and Yasuhei SATO (Bull. Tokyo Univ. Forests. **38**, 1-41, 1950.)

To find principles of improvement of earth kiln, comparative experiments by four kilns in making of charcoal were carried out, i.e., by "Nooringama No. 1", "Tokitagama", "Ooishigama" and "Miura's standard kiln". Results were as following:

(1) In building of kilns, "Miura's standard kiln" was the most easy and other three kilns were more complex in order as "Tokitagama", "Nooringama No. 1" and "Ooishigama".

(2) To produce charcoal the longest time was necessary for "Nooringama No. 1" and it became gradually shorter in order as for "Tokitagama", "Miura's standard kiln" and "Ooishigama".

(3) The operation of making charcoal was so simple by "Ooishigama" that the hardening of charcoal was not presumable but spontaneous and in the case of other kilns the operation was complex test.

(4) In relative yield test of charcoal (yield of charcoal/average carbonizability of materials by sample) "Tokitagama" and "Nooringama No. 1" have the highest results, and "Miura's standard kiln" comes next, and "Ooishgama" is at the last.

(5) In the shrinking by sample test, at the longitude, circumference and volume, "Nooringama No. 1" is the largest, next "Tokitagama" and "Miura's standard kiln", and "Ooishigama" is the smallest.

(6) In the hardness, "Miura's standard kiln" is the highest and "Nooringama No. 1" and "Tokitagama" succeed the former.

(7) In the volumetric gravity of charcoal the enormous difference among kilns was not found, but the tendency of difference was the same as in the hardness.

(8) In considering results mentioned, it can be concluded that "Nooringama No. 1" and "Tokitagama" are excellent.

174. Studies on carbonization of wood (2). Takeo SHIBAMOTO, Akira KURIYAMA and Masaru HIGUCHI (Journ. Jap. Forestry Soc. **32**, 47-50, 1950.)

This study was carried out with woods of *Quercus serrata* THUNB. containing various quantities of water, using the SCHRADER'S aluminium retort of about 500 cc capacity. To obtain samples of various moisture contents, the woods were treated in the same way.

The results obtained as follows:

(1) The yields of the products of the destructive distillation on weight of fresh woods and the dried-woods, and concentration of acetic acid in distilled liquor were same as in the case of the previous report.

(2) The volumetric gravity of charcoal was largest in the case of fresh wood not air-dried after being cut down and became smaller gradually in accordance with moisture content of the wood decreased, but these facts were not obvious in the case of woods which were once air-dried up to less than 10% in moisture content, and then dipped in water to absorb it and air-dried again.

(3) The course of the destructive distillation of wood could be divided into 4 stages distinctly. Water was distilled mostly at 150-200°C in the retort wall, distilled liquor and wood-gas were run out a little at 200-275°C, much at 275-300°C, and then distilled liquor again less and wood-gas comparatively much at 300-400°C.

(4) The distilled liquor at 250-400°C contained settled tar.

(5) The concentration of acetic acid was high in distilled liquor at 200-275°C, but that of methanol was contained much in the distillate at 275-350°C.

(6) It was be supposed that in the former temperature range most of cellulose and in the latter tetmperature range most of lignin were decomposed.

175. Studies on waterculture of tree-seedings (3). Takeo SHIBAMOTO and Suemoto TAKAHARA (Bull. Tokyo Univ. Forest. **38**, 59-69, 1950.)

The relationship between the reaction of two kinds of nutrient solution containing NO_3-N or NH_4-N as N source and the growth of yearling seedling of *Cryptomeria japonica* DON and *Pinus densiflora* S. et Z. and two years old seedling of *Zelkowa serrata* MAKINO at the University Forest in Chiba, were studied and obtained the following results:

(1) Each nutrient solution showed the same inclination to change its adjusted acid or alkaline reaction into neutral along with the lapse of time. Perhaps water used must account for it, as the greater part of the variational magnitude is attained within 24 hours.

(2) The variational magnitude of the reaction reached the maximum at pH 5.0, and was greater at the nursing plots of seedling than at the non-nursing.

(3) Renewing the nutrient solution in use within three days, the variationable magnitude of reaction remained within a unit of pH.

(4) The pH range for growth and existence of seedling seemed wider in NO_3-N nutrient solution than in NH_4-N nutrient solution.

(5) The resistance of seedlings against the acidity was more remarkable in NO_3-N nutrient solution than in NH_4-N nutrient solution, and the largest in *Pinus densiflora* S. et Z. and next *Cryptomeria japonica* Don and the last in *Zelkowa serrata* MAKINO.

(6) The resistance of seedlings against the alkality was the largest in *Zelkowa serrata* MAKINO, and next in *Cryptomeria japonica* DON and last in *Pinus densiflora* S. et. Z. .

(7) On the pH range for growth, especially optimum pH of seedling, the following results were obtained:

Kind of nutrient solution	seedlings	pH range for growth	Opt. pH
NO_3-N nutrient solution	*Pinus densflora* S. et Z.	3.0−5.5	3.0−4.0
	Cryptomeria japonica DON	3.5−6.5	4.0−5.5
	Zelkowa serrata MAKINO	3.5−8.0	4.5−6.0
NH_4-N nutrient solution	*Pinus densiflora* S. et Z.	3.0−6.0	3.0−5.5
	Cryptomeria japonica DON	3.5−6.0	4.5−5.5
	Zelkowa serrata MAKINO	4.0−5.5	5.0−5.5

176. Studies on the watercultures of tree-seedlings (4). Takeo SHIBAMOTO, Suemoto TAKAHARA and Akira KAWANA (Bull. Tokyo Univ. Forests. **38**, 71-93, 1950.)

The results obtained in these studies are as follows:

(1) *Cryptomeria japonica* DON: In NO_3-N nutrient solution, the growth of yearling seedling was better at pH 4 and 5. In NH_4-N, the best growth was observed at pH 4.

(2) *Pinus densiflora* S. et Z.: In NO_3-N, the growth was better at pH 3, 4 and 5. In NH_4-N, the growth was better at pH 3, 4 and 5.

(3) *Cinnamomum Canphora* SIEB.: In NO_3-N, the growth was better at pH 4 and 5. In NH_4-N, the best growth was found at pH 4.

(4) *Zelkowa serrata* MAKINO: In NO_3-N, the growth was better at pH 4, 5 and 6.

(5) In relation of the kinds of N source and growth of seedling, between NH_4-N and NO_3-N, the difference was hardly found in the case of *Pinus*, but *Cryptomeria* and *Cinnamomum*, the growth of seedlings was better in NO_3-N at optimum pH.

177. Studies on the animal food manufacture from various fibrous materials by microbe (1). Takeo SHIBAMOTO and Takaharu SHOJI (Bull. Tokyo Univ. Forests **38**, 113-121, 1950.)

In this study the agricultural worthless products *Kumazasa* (*Sasa* sp.), Zassô (various wild grasses mixture), Kansho-zuru (stems and leave of *Ipomoea Batatas* LAM. var. *dulis* MAKINO) were used as samples and *Aspergillus Ogurae* as microbe. It was found that these materials could be improved as animal food, especially, in their crude fiber and crude proteine contents.

178. Studies on carbonization of wood (8). Takeo SHIBAMOTO and Osamu SATO. (Bull. Tokyo Univ. Forests. **38**, 43-57, 1950.)

The new designed Kiln, "Kiyozumi earthen kiln G-type", is belonged to standard type of earthen kiln in our country, and very simple one. It is easy to build it and no special material is needed. As this kiln is the slightly improved one of usual kiln at the smokecanal and the heating mechanism, it is easy for the already constructed kiln to be reconstructed to this type. Operation of making of charcoal by this kiln is rational, simple and of high efficiency. Result of production of charcoal was very excellent and not inferior to that of the modern so-called first-ranked improved kilns. As a conclusion, the so-called kiln must be inquired in their construction and operation.

179. Studies on carbonization of wood (6). Takeo SHIBAMOTO, Kyoji MINAMI and Hiroshi SAKAI (Journ. Jap. Forestry Soc. **33**, 12-17, 1951.)

In comparing results on and after second time in serial distillations, it was found that the wood of low moisture gave a little more acetic acid, tar and charcoal than the one of high moisture content, but in the latter, the amount of fixed carbon was found to be larger than in the former. In the amount of fuel, in such a scale as this retort, the remarkable difference with moisture content of wood, was not found among the succeeding times of serial distillations. The moisture content of wood gave no obvious effect on the time necessary for distilling of wood at the succeeding times of serial distillations, but at the first, the wood of high moisture content consumed more fuerl and longer time for its distillation. By passing the hot exhausted gas of fire-place through the retort, fuel and period were reduced, especially the fuel was reduced in the first time of serial distillations. Then by this treatment, the amount of distilled water at the dehydrating period was increased and at the carbonization period pyroligeous liquor was condensed. Independently of effects of passing the hot exhausted gas and the moisture content of wood, in serial distillations, the great difference was observed between the first time and the succeeding times, that is.... at the succeeding times, amount of fuel was reduced to 60% of it at the first time and the distilling period was shortened an hour.

180. Studies on carbonization of wood (5). Takeo SHIBAMOTO, Kyoji MINAMI and Hiroshi SAKAI (Journ. Jap. Forestry Soc. **32**, 400-402, 1950.)

As method of seasoning of wood, the following four methods were compared:

(1) roasting method as usual in the case of retort, (2) adopting of roasting and simultaneous direct heating of wood with the hot gas generated by the charcoal gas producer, (3) simple direct heating of wood with the hot gas generated by the charcoal gas producer, and (4) adopting of roasting and simultaneous direct heating of wood with the hot exhausted gas from the fire place. According to the results, the most

excellent one was the fourth. By this method, convection of air in the retort being promoted, much of moisture was rapidly carried off and the special fuel was unnecessary.

181. Studies on carbonization of wood (4). Takeo SHIBAMOTO, Kyoji MINAMI and Hiroshi SAKAI (Journ. Jap. Forestry Soc. **32**, 372-377, 1950.)

At the Tokyo University Forest in Chiba parallel experiments were carried out with green wood and seasoned wood, respectively 3 times uncontinuously, by the plant of dry distillation of wood in a semi-industrial scale. According to the results, when with the seasoned wood, it was acertained that the shortening of the distilling hours, higher yelds of valuable products and concentration of pyroligneous acid were realized. When with the green wood, if the drying of it was sufficiently executed for a long time, the yields of charcoal, tar and acetic acid were a little increased and hardness of charcoal was remarkably enhanced.

182. Studies on carbonization of wood (3). Takeo SHIBAMOTO, Akira KURIYAMA and Osamu SATO (Journ. Jap. Forestry Soc. **32**, 75-83, 1950.)

This study was carried out with wood of *Quercus* and many other species freshly cut down or air-dried for 1-10 months, containing various quantities of water, using the black-charcoal-kilns of "Tokita-Gama" of 2.7 m long and "Hyojun-Gama" of 3.6 m long. The results obtained are as follows:

(1) The yield of charcoal by weight percentage based on water-containing wood became larger gradually, in accordance with moisture content of the wood decreased, but the moisture content had scarcely any influence on yield percentage based on absolutely dried wood.

(2) The volume of charcoal obtained from unit volume of wood became larger gradually, in accordance with moisture content decreased.

(3) The volumetric gravity and hardness of charcoal became small gradually, in accordance with moisture content of the wood decreased, and this tendency was especially remarkable in the case of wood.

(4) It was revealed by this experiments of black-charcoal-making, in accordance with moisture content of wood decreased, quality of charcoal obtained became bad, and it is supposed the most advantageous water content of wood in black-charcoal-making be 30-35%.

183. On the essential oil of *Todomatsu* balsam. (Studies on *Todomatsu balsam* II.) Takeo SHIBAMOTO, Kyoji MINAMI and Makoto MIYAZAKI (Bull. Tokyo Univ. Forests **38**, 95-112, 1950.)

The yield of essential oil obtained by steam distillation of *Todomatsu* balsam (resin of *Abies Mayriana* MIYABE et KUDO and *Abies sachalinensis* MAST.) was 23.5%. After distilling it in vacco into eight fractions, the research of the components of each fraction was done and α-Pinene, Camphene, β-Pinene, Bornylacetate and an alcoholic substance were found. The fraction, b.p. 160-174°C, gave an unknown nitrosochloride.

184. Studies on carbonization of wood (1). Takeo SHIBAMOTO and Akira KURIYAMA (Journ. Jap. Forestry Soc. **32**, 43-46, 1950.)

The study was carried out with woods of *Quercus serrata* THUNB. containing various quantities of water, using iron retort of about 7 l capacity. To obtain

samples of various moisture contents, the woods were treated in three different ways, as follows:

(1) Woods were cut down and air-dried up to such moisture contents as 40%, 30%, 25%, 10%, and less than 10% respectively.

(2) Air-dried wood of lower than 10% moisture content were dipped in water to absorb it fully and then air-dried again up to such moisture content as 40%, 30%, and 25%, respectively.

(3) Woods freshly cut down were soon dipped in water to absorb it fully.

The following results are obtained:

(a) The yields of the products of the destructive distillation on weight of the samples, charcoal, acids in distilled liquor (mostly acetic acid) and wood-gas (including loss) increased, and distilled liquor (including settled tar) decreased, in accordance with the moisture content of the samples decreased.

(b) The moisture content of the samples had not any effect on the yield of these products per weight of the absolutely dry samples.

(c) In accordance with the moisture content of the samples decreased, concentration of acids in distilled liquor increased.

(d) The volumetric gravity of charcoal was largest in the case of wood not air-dried after being cut down.

(e) In the destructive distillation, water was distilled almost at 100-150°C in the retort, the wood was decomposed gradually at 150-250°C and then temperature rised rapidly, much distilled liquor was run out, and much wood-gas was exhausted, at 250-350°C.

The wood-gas was composed of CO_2 and CO for the most part at 150-300°C, namely of about 60% CO_2 and 20-30% CO.

185. Content of tannin in the barks of *Acacia mollisima* in Chiba Prefecture. Takeo SHIBAMOTO, Kyoji MINAMI and Sumiko KUBOTA (Journ. Jap. Forestry Soc. **32**, 295-296, 1950.)

The content of tannin in the barks of *Acacia mollisima* grown in Chiba Prefecture was determined as 22 and 29%. These values are almost the same as those reported on the samples of Formosa and Wakayama Prefecture, but considerably lower than that of its native land.

186. Fundamental studies on the plup making from the hardwood. (I) Studies on the xylan xanthogenate. (1) The amounts of alkali combined with xylan. Nobuhiko MIGITA, Hayao HOSOI and Junzo NAKANO (Journ. Soc. Textile and Cellulose Indust. **6**, 394-398, 1950.)

The xylan prepared from rice straw was immersed in sodium hydroxide solution of various concentrations, and the amounts of alkali combined with the xylan were determined. Increase in concentration of sodium hydroxide solution increased the amounts of alkali combined with xylan. The curve of alkali absorption of xylan is somewhat resembled to those in cellulose.

187. Fundamental studies on the pulp making from the hardwood. (II) Xanthogenation of alkali xylan. Nobuhiko MIGITA, Junzo NAKANO and Rikigi GODAI (Journ. Soc. Textile and Cellulose Indust. **6**, 398-400, 1950.)

Xanthogenation of the alkali xylan was carried out. As the amounts of combined sodium and sulphur in the resulting product were little, it can not be considered as xylanxanthogenate.

188. Fundamental research on the pulp making from the hardwood. (III) Purification of the beech wood pulp by screening. Nobuhiko MIGITA, Hayao HOSOI and Rokugiro HIGAKI (Journ. Soc. Textile and Cellulose Indust. 7, 88-92, 1951.)

Viscose prepared from the beech wood pulp, which had been purified by screening, is superior in cleaness and easier of filtration than the viscose from the original beech woodpulp. The uniformity of cells in morphological sense seems to be of greater significance than the purity in chemical sense.

189. The reactions of formaldehyde to xylan. (I) The preparation of formaldehyde-xylan. Nobuhiko MIGITA, Junzo NAKANO and Tadashi NAGANO (Journ. Soc. Textile and Cellulose Indust. 7, 270-273, 1951.)

The reactions between xylan and formaldehyde are examined in relation to xanthation of formaldehyde treated pulp. Several factors affecting reactions are investigated. The amount of formaldehyde combined with xylan was found to be 20.5%.

190. The reactions of formaldehyle to xylan. (II) The mechanism of reaction of formaldehyde to xylan. Nobuhiko MIGITA, Junzo NAKANO and Tadashi NAGANO (Journ. Soc. Textile and Cellulose Indust. 7, 273-277, 1951.)

The mechanism of reaction and the chemical properties of formaldehyde-xylan were studied. The maximum amount of formaldehyde combined with xylan was 20.5%. This value corresponds to the theoretical value, if xylan is assumed to be combined with formaldehyde in the forms of inter- or intra-molecular binding. Interesting facts were observed in the preparation of methyl and acetyl derivatives of the formaldehyde-xylan. The formaldehyde-xylan could not be xanthated within a range of experiments.

191. Chemical studies of cork substance. (I) Chemical composition of cork of *Quercus variabilis*. Nobuhiko MIGITA, Takashi KANDA and Yasuto HASHIMOTO (Journ. Jap. Forest. Soc. 33, 102-105, 1951.)

The cork-bark of *Abemaki* (*Quercus variabilis*) was analyzed with the usual method employed for the analysis of wood. Suberin was determined with the method proposed by ZETZSCHE. Due to the presence of suberin in cork, the Cross-Beven method and the 72% sulphuric acid method gave the unproperly high value at the determination of cellulose and lignin, respectively. For the determination of cellulose of cork, the method, at which the sample is treated alcoholic-nitric acid solution and then treated with alcoholic-potassium hydroxide solution, may be applicable. The extraneous components of cork were divided into groups of chemically similar substances. Yield and some properties of the each fraction were examined.

VII. Zootechnical and Veterinary Science

Abstracts Nos. 192—210

192. Studies on the shape and structure of phalanx of horse. I. About asymmetry of articular surface and rotation of its axis in the first phalanx. Shin-ichi NOMURA (Jap. Journ. Veter. Sci. 12, 219-230, 1950.)

The object of these studies is to observe the characteristics of phalanx and to

determine the foot-axis, which is employed for the foundation of rational horse-shoeing.

The projecting-method to reproduce the shape of the articular surface is adopted. The bone-axis as a straight line between the deepest points in surcus verticilli and intercondylicus is decided at first. The borders of proximal and distal surface and the measuring points are projected on a plane, which is perpendicular to the bone-axis. On this figure coordinate is constituted; its origin is the projected bone-axis and the axis of ordinate is the middle-sagittal line of surcus verticilli.

For the purpose of demonstrating the characteristic configuration of the articular surface its width, thickness, total and in-and-half area and the curvature of borders on the projected figure are measured. Rotation of axis, constituted between the proximal and distal surface, is represented by a declination angle of distal-sagittal axis to ordinate or by an angle, placed between the transverse axis of the upper and lower surface.

The pecurialities of the first phalanx reduced from contrasting and discussing these measurements are:

(1) The breadth: Articular surface of the hind phalanx is a little broader than that of the fore. The inside half is generally wider than the outside.

(2) The thickness: The thickness along the middle groove of the fore phalanx may be a little greater than that of the hind. The medial part is thicker than the lateral.

(3) The area: So far as dimensions are concerned, many of the area of the projected surfaces present quite insignificant deviation between the fore and hind phalanx. With the exceptions of some distal surfaces, the inside part is in general wider than the outside.

(4) The curvature: The arcus of the inside border goes more strongly round than that of the outside.

(5) Regarding to the sagittal axis, its rotation is remarkable; it always occurs inwards, and the transverse axis has also the same tendency with a few exceptions.

193. Studies on the shape of articular surface. I. About the method. Shin-ichi NOMURA (Jap. Journ. Veter. Sci. **12**, 71-85, 1950.)

In general the joints of vertebrata consist of two elements, the concave cavity articulating with the convex heads. A slight amount of deformation, which the cartilage of the articulating surface permits, makes it easy for the elements to be congruent together. Therefore, it can be conceived, the joint as a constrained pair is being composed of two geometrical surfaces. This report has been based upon the previous conceptions which show that the concave or convex curve of the sawed articular is like a geometrical one; hence, that the movement of bone and extremity will be chiefly stimulated from the geometrical shape of the joined surfaces.

This will be discussed under the following methods:

(a) The curve of the articular surface may be drawn with the "MAKO", the copying tool, indirectly. Observation, measuring and other discussions for the shape will be performed on the curve, which has been copied on the section paper.

(b) Before applying the measurement data to conclude the radius and centre of curvature, they will be graduated on the paper by Figure-method or parabolic moving average method. Through these methods one can avoid a faulty conclusion because of measuring errors and of other inevitable, inaccurate observation.

(c) The graduated values will be joined three apiece. Each group is available for calculation of the radius and centre of curvature, by the auther's method.

(d) The geometrical curve, resembling the sawed articular surface, will be surmised through the locus of the centres of curvature. The articular surface, being characterized by a regular shape, will be constructed analytical-geometrical method with the surmise.

(e) On the other hand, the theoretical range of joint-movement, which is circumscribed through the shape, will be calculated on the approximate circle.

194. Studies on the shape of articular surface. II. About the geometrical curve, resembling the sawed articular surface of fore leg. Shin-ichi NOMURA (Jap. Journ. Veter. Sci. **13**, 107-119, 1951.)

Examining the external form and rough structure, it is evident that the general movement of the joints of the foreleg is usually ginglimus-like, so that if we know the shape of the sagittal sawed surface, we will be able to recognize a characteristic type of their motion.

The analysis of the shape on the sagittal plane gives the following conceptions:

(a) According to the common knowledge the joint-movement of the foreleg is accomplished by sliding between articulate surfaces only, so the sagittal curve must be a regular circle. The analysis, however, has shown the fact that the curves of the convex heads and trochleas, etc. are nearer to ellipse or circle, and these of the concave cavities are alike to parabola.

(b) The approximate circle of the concave cavity has always a greater radius than that of the articulating convex head.

(c) An arrangement of the delicate deviations from the geometrical curve makes it clear that the supporting region of head or trochlea, when the limbs stand in their normal position is slightly depressed and that of the concave cavity somewhat sank. The cartilage on these deviated regions is thicker than on other parts in order to support more elastically the body-weight along the limbshaft. Another notable fact is that the radius of curvature increases at the end region of the articular surfaces. It shows that the increasing fractional force between the connected surfaces will charge gradually the speed of the relative movement of the joint.

195. Studies on the function of male sexual organs during the maturation process I. Oxygen consumption and aerobic glycolysis of the testicular tissue in the rat. Yoshisuke SUZUKI (Med. and Biol. **17**, 98-101, 1950.)

Using the manometric technique, respiration and aerobic glycolysis were measured on the decapsulated finely teased testicular tissues of rats at various stages of the growing period. The metabolic rates were represented as μl of oxygen consumed and μl of CO_2 evolved from the aerobic medium containing carbonate by 100 mg of the fresh tissue per hour respectively.

In the respiration rate, a significant difference was not found with advancing of age. But slightly higher value was observed in 20-50 days of age (ca. 80-105 μl) and then it showed progressive fall towards adult's value (ca. 75-85 μl).

On the other hand, the transition in the aerobic glycolysis rate was significant. Until 20 or 30th day of age, this rate remained at ca. 40-60 μl, then it temporarily rose up to some 140 μl at around 40th day. It then decreased towards 70th day to the level of adult, in which 60-70 μl were maintained. Both metabolic rates of the testes obtained from the rat, in which senility changes had set in, were very low, especially in the aerobic glycolysis.

It was interesting to note that this transient and significant rise in the aerobic glycolysis rate was observed at the stage just before when the testes underwent their rapid growth with the progress of sexual maturation, and it also coincided with the beginning of the descent of testes. In this period, the accessory glands had not begun a significant growth, still staying in the immature state.

From these findings, it may be assumed that there is a striking hyperfunction of the testicular cells, especially of the germinal epithel system, and it marks the advent of the sexual maturation.

196. Studies on the function of male sexual organs during the maturation process. II. New kinds of seminal ejaculation in the rat and the change of their capacity with the progress of age. Yoshisuke SUZUKI (Med. and Biol. 17, 156-159, 1950.)

The present report consists of the findings on the new ejaculatory responses and their application as the indicator of the analyses of the developmental pattern of ejaculatory function in the rat.

1. New ejaculatory responses in the rat.

The ether ejaculation ("E"): In considerable numbers of adults, the ejaculation takes place almost within ten minutes after the withdrawal of ether anaesthesia without applying any stimulus. The spontaneous ejaculation ("S"): Some adults, though on rare occasion, ejaculate spontaneously in few minutes during the handling of the animal. The blow on head ejaculation ("BH"): In almost all of adults, death convulsion by a blow on the head is accompanied by the ejaculation.

The occurrence of these three responses with advancing of age were studied with the results as follows: Positive responses of "E" began to appear at about 60 days of age. At the beginning, its percentage was quite low, then increased gradually in sigmoid shape until about 160th day and thereafter remained at the maximal level of about 80% positive. On the other hand, "BH" began to appear also at about 60th day with a high positive rate (60%) from the beginning and soon attained to its maximal level (90%) at about 90th day. On the contrary, "S" was not observed before 100th day and even in the later stage of life it remained within only 20%.

The remarkable divergence among them may be due to the difference in their ejaculatory capacities which are required for the induction of respective responses. That is to say, the capacities to response are maximal, submaximal and minimal respectively in "S" and "E" and then "BH" ejaculation.

2. These responses as the indicators of the establishment of ejaculatory function, and of the reproductive activity.

As for "BH" response, it is assumed that all animals which have ejaculately function always, can be forced to ejaculate if the abnormal stimuli such as the head blow are given. Because, the negative responses of "BH" are almost limited in the following cases—i) adults killed without convulsion; ii) some cases were "BH" test carried out soon after a previous ejaculation; iii) adults which testes ascended into abdominal cavity due to the extreme exhaustion or the senility; iv) immature or young rat, which tail of epididymis contained no sperm. Therefore this response may be used as the indicator of the establishment of the ejaculatory function.

To discuss the mechanism of "E" and "S" is premature and speculative in the present stage of this study. Aside from this question, however, "E" and "S" responses may be provided as the indicator to estimate the activity of the reproductive function.

Because it was confirmed in the later unpublished data that the fertilizing capacities of the male rats which had higher rate of "E" and "S" surpassed that of the lower rate, that is,—the rats having 100, 100, 60. 33, 20, 13, 13, and 0% of the frequencies of positive "E" & "S" respectively showed 83, 80, 56, 33, 42, 22, 0, and 17% of the fertilizing capacity.

3. The developmental pattern of the ejaculatory function and the reproductive activity in the rat.

From these findings it seems to be quite adequate that the seminal ejaculation is an integral part of the whole functions of sexual phenomena in the male, and the transition of these responses with the progress of age would reveal the developmental pattern of ejaculatory function and the reproductive activity in the rat. The establishment of ejaculatory function may take place in 60-90 days of age. (cf. "BH" curve) This is regarded as the period of the sexual maturity, on account of the fact that in this period not only the establishment of the ejaculatory function but also the most important changes concerning the sexual function occur or have occurred. As for the ejaculatory capacities or the reproductive activity, it may be admitted that when the animal attains to the sexual maturity, it remains at first on a low level, gradually increasing to the maximal level towards about 160 days of age. (cf, "E" & "S" curves) That is to say, the rat attains to its most active stage of reproduction at five months after the birth.

197. Studies on the function of male sexual organs during the maturation process. III. The relationship between the shape of penis and the development of internal sexual organs in the rat. Yoshisuke SUZUKI (Med. and Biol. **18**, 199-202, 1951.)

For the external sign, accompanied with the progress of sexual maturation, the descent of testes only has been paid attention. But this phenomenon is rather vague, because of its gradual progress. Meanwhile it become clear that the extremity of the rat's penis turned into three different shapes with the progress of its sexual maturation.

Surveying a colony of the rats observed, it was found that the penis of almost all of rats which age were before 40th day had the similar appearance to that of the clitoris of the female, and its glans of penis were hard to be exposed. Temporarily, this shape was named the immature type (V type). After this stage, the glans could be exposed easily and the os priapi protruded in some hooked shape on it. During 40-70 days of age, most of the rats had this pubertal type (W type). Thereafter, in the adults, the glans became to be exposed more easily than in the former stage, however, the protrusion of the hooked structure ceased to appear, being buried in the growing glans. This was named the adult type (U type).

It was noteworthy to be reminded that the period when the shifting of "V" type to "W" type took place, coincided with that of the onset of the testicular descent, and of the significant rise of the aerobic glycolysis rate in the testes as stated in the paper I. On the other hand, the shifting period of "W" to "U" type coincided with the beginning of the significant growth of the accessories and of the establishment of ejaculatory function as seen in the paper II.

Furthermore, it was found that, in the comparison of the growth of the inner sexual organs between the animals of "U" and "W" types at the same age, the former were remarkably heavier than the latter in weight, especially in the accessories,

despite of the same somatic growth, and the whole function of the reproduction seemed to be accomplished.

From these findings, it may be admitted that these two shifting periods of the three types of the penis would mark the important epochs of the commencing of the sexual maturation process, and of its accomplishment respectively. The rat in "W" tyep is considered to be in the stage of adolescence, after the completion of puberty. And the rat in "U" type represent those which have attained to the sexual maturity.

198. On the seminal ejaculation. I. The "Alcohol Ejaculation" in the rat. Yoshisuke SUZUKI (Med. and Biol. **19**, 162-164, 1951.)

It was found that the administration of ethyl alcohol could induce the similar kind of ejaculaion as in the "ether ejaculation" described in the previous report. In 80% of adult rats, ejaculations took place almost within 20 minutes after the injections of 240 and 480 mg of alcohol subcutaneously. The progressive fall of the rate of the response was observed in the tests with the administration of the larger dose than this range. This response, temporarily called the "alcohol ejaculation", was regarded as to be the same mechanism for its induction that of the "ether ejaculation", except some slight differences.

It may be premature to discuss the mechanism of these ejaculations induced by the aliphatic anaesthetics. But, tentatively the following explanation for the response was proposed:

As the spinal reflexes, in general, are usually suppressed by the hihger central nervous system so the spinal centre of ejaculation would be subjected to continual inhibitory action from the higher centre. When the excitability of the spinal centre is high enough even mere removal of the inhibition from the higher centre could induce the ejaculation of its own accord. The removal of inhibition would be accomplished by the temporary anaesthetic effect of ether inhalation, or by the injection of some suitable dose of alcohol. In the excess dose of alcohol, its continual paralytic effect may so soon develop not only on the higher centre but also on the lower mechanism of ejaculatory path that the ejaculation would not be induced.

199. On the seminal ejaculation. II. Induction of the precocity, especially of ejaculatory capacity, by androgen and prolan treatments in immature rats. Yoshisuke SUZUKI, Yasuo TOSHIMORI and Noboru YOTSUYANAGI (Med. and Biol. **19**, 221-224, 1951.)

By the administrations of androgen or prolan to immature rats, the "ether ejaculation" ("E") could be induced before 50th day of age, in almost of all test animals, and the "spontaneous ejaculation" ("S") was also obtained in considerable numbers of them, while, none of these responses was obtained in the controls at this period. The ejaculates, recovered before 50th day, consisted of only the vaginal plug but sperm cells. As for the "spontaneous ejaculation" of immature rats, induced by ICSH fraction, it has been incidentally referred in the paper of Greep et al (1936).

Further, it was found that the adult type of penis (U type) was brought by these treatments before 50th day, whereas the controls stayed in the stage of the pubertal type of penis (W type).

From these results, it seemed probable that:

(1) The penile changes, described in the previous paper, are accomplished by the action of androgen and would tell the periods when the changes of the condition of its secretion take place.

(2) The ejaculatory function is controlled by androgen as stated by MOORE and GALLAPHER (1930). And the ejaculatory capacity of immature rats would be so elevated as to be enough to induce the "E" or "S" responses by the action of androgen.

200. Studies on the serum-cholinesterase of livestock. Especially about the normal activities of horses. Toshio OKABE, Takayoshi MIURA and Yoshio SHIMODA (Med. and Biol. **16**, 15-17, 1950.)

Since STEDMAN et al. reported the activities of serum-cholinesterase about man and other animals many studies on the minute details about them have been reported. But, surprisingly, there is a very little knowledge about the cholinesterase of livestock.

We measured the activities of serum-cholinesterase about the several species of livestock and made a comparison between the species by estimating their distribution's rejection limits and mean value's confidence limits. And specially about horses, we determined the normal or physiological activity by measuring more than 700 examples and made more detailed studies on comparisons between its races, sex, ages and times.

The results obtained are as follows:

(1) The serum-cholinesterase activity of horse, mule or donkey is distinctly the largest of all and of swine is the next, then of sheep, goat and cow comes in order.

(2) The normal serum-chlinesterase activities of Japanese horses are distributed between 1.635—2.763 and their mean value must be between 2.175—2.223.

(3) The differences between races and sex are not significant, but the activities of Kiso-ponies (Mean value 2.003—2.165) are smaller than that of any other horses.

(4) The activity seems to become larger by ages, but only the activity of the yearling (Mean value 1.903—2.127) is significantly small.

(5) The activities are different in the seasons of a year obviously. In winter and spring they are indicated larger than in summer and autumns. In this respect, the Kiso-ponies are peculiar as there are no differences shown their activities in winter and summer.

(6) The activities may be different in the various times in a day, but they are not significant mathematically.

In conclusion, it can be said that the activities of serum-cholinesterase of livestock, especially of horses, are considerably different by individuals, but their distribution is recognized as the normal distribution in each case, and are maintained their levels while the animals are kept in physiological conditions, except the influence by the seasons of a year.

201. Physiology and pharmacology of intestinal movement. Part I. Observations on the movements of the small intestine in normal feeding and hunger. Yoshio OKUBO, Ushio TANAKA and Iwao YANAGIYA (Folia pharmacol. japon **45**, 157-162, 1950.)

Observations on the intestinal movements in situ were carried out with rabbits in abdominal window of glass and silver frame. This report presents the results in detail obtained in normal feeding and hunger.

1. Movements in normal feeding.

Three typical modi of movements, as have been distinguished by HUKUHARA (Pflügers Arch, Bd. 235, 1934), can be observed in the normal intestinal movements, and these movements are called here the pendular movement, rhythmic segmentation and peristalsis respectively according to HUKUHARA.

The results obtained show that, during twelve hours after taking diet, both

peristalsis and rhythmic segmentation are observed, but no pendular movement.

The frequency of peristalsis shows a transient increase at first and then a gradual decrease until it gets to a constant level. The change in frequency of segmentations is similar to that of peristalsis, but not so distinct. Besides these changes of frequency, gradual prolongation of the rhythm and weakening of contractility in these two movements are observed.

After twenty-four hours' fasting, the intestinal movements increase in frequency, being accompanied by some prompting in contractility.

2. Movements in fasting animals.

Twenty rabbits previously starved for two to ten days were used. In each of the fasting animals the intestinal movements are less frequent, with longer rhythm and weaker contraction. There are also tone rising and vascular constriction in many cases observed.

The following changes in motility may be characteristic of the intestine during the starvation.

(1) Continuous appearance of the seight fluctuations in motility besides its general change.

(2) Appearance of the pendular movement which never occurs in normal feeding; the rhythmic segmentation becomes less frequent on the contrary.

(3) All the types of movements having the tendency to be transitionary forms.

Starvation for longer periods (nine to ten days) caused an augmentation of movements in the last one or two days of the period.

202. Physiology and pharmacology of intestinal movement. Part II. Observations in rabbits taking diet. Yoshio OKUBO, Ushio TANAKA and Iwao YANAGIYA (Folia pharmacol. japon. 45, 163-166, 1950.)

All the experiments were performed on rabbits with abdominal window. The results obtained are as follows:

(1) A few minutes after taking diet, the small intestine increases its motility in regard to both the strength of contraction and the frequency of movement, and vasodilation of peripheral blood vessels on the intestinal wall was demonstrated. When the animal finished to take diet, the motility decreased clearly to certain level, though being still more active than the normal.

(2) As above mentioned the excitement of intestinal motility occurs far before the time when the intestinal loop under observation began to increase in content. Fasting animals were used in these experiments in order to observe the changes of intestinal content clearly.

(3) An experimental diet (starch paste or liquid paraffin) given directly into a stomach by a catheter also produces the excitement of intestinal motility, it occurs, however, far later than a diet taken arbitrary per os. At a loop of under observation, we used to observe both the motor excitement and the increase of content occurs concurrently.

From the above observations we may assume that stimulation on intestinal motility in an animal taking diet would be of reflex nature, whereby the stomach would play no rôle in provoking the reflex.

(4) In next series of experiments, the influence on intestinal movement was to be observed when diet was only shown to rabbits. Such experiment caused the same

immediate motor stimulation as well as in case of diet, normally given. Accordingly it may be assumed that such excitement occurs as the result of reflex stimulation.

Generally speaking, therefore, the intestinal excitement may occur as the first phase, by perceiving diet, when it is given and secondly accelerated by the diet itself when it is taken in by animal.

203. Physiology and pharmacology of intestinal movement. Part III. Effects of the volume of intestinal content on the intestinal movement. Yoshio OKUBO, Ushio TANAKA and Iwao YANAGIYA (Folia pharmacol. japon. **47**, 15-20, 1950.)

Three types of the movement were observed in the occurrence during the normal intestinal movements of a rabbit by means of a glass abdominal window. Frequency of the appearance of each type of the movement is controlled by the volume of intestinal content. When a large quantity of fodder is taken, the principal movement becomes the peristalsis. If the fodder taken is moderate, the rhythmic segmentation set out more than half. A small quantity of fodder taken provokes the pendular movement. The above conclusions are not only affected by the kind of fodder, but by substitutes of isotonic solutions for fodder. It could be demonstrated of these findings by an in vitro experiment using an excised intestine connected in a circle.

204. Studies on furacin treatment in experimental chicken coccidiosis. Ushio TANAKA, Yoshio OKUBO, Mitsuyoshi IKEDA and Norimoto URAKAWA (Journ. Jap. Vet. Med. Ass. **3**, 203-206, 1950.)

The anticoccidial action of furacin was first described by HARWOOD and STUNZ (1949), on experimental coccidiosis in young chickens. Studies on efficacy of furacin in the therapy of experimental coccidiosis were designed by the authors independently, and similar results were obtained.

The furacin preparation used, Monafuracin, which is manufactured by Nihon Seiyaku Co., is chemically 5-nitro-2-furaldehyde semicarbazone.

At 2 weeks of age the chicks were banded, weighed and separated into groups of approximately 10 birds. These birds weighed every 3 days, and 2 or 3 days after banding they were inoculated by the crop with a syringe individually with approximately 60,000-90,000 oocysts of *E. tenella* and the treatment started at the time of infection. The drug was administered to the chickens in all-mash feed, or drinking water, at several different concentrations and at different times after the day of infection. On the 8th day after infection, all survivors were killed to be autopsied.

The chief criteria showing effectiveness throughout these experiments were the deaths, weight gains, bloody droppings, lessions of ceca and toxic effects of the drug in control and treated groups.

The results obtained are as follows:

(1) The birds, which furacin mixed in all-mash feed in 1:6,000 were administered, developed no clinical symptoms of coccidiosis, but showed a decrease in weight and suffered a decrease of the uptake of the feed. The one to 9,000 level of the drug was sufficient to prevent losses of the disease although it could not completely destroy the parasite, but there were often only a few bloody droppings on the fifth and sixth days after infections among these treated birds. One part of the drug in 12,000 parts of feed or even in 15,000 parts seems to have some beneficial effect on the course of the disease since these reduce the loss significantly, as compared to those of control groups.

(2) Studies on the treatment started at various times after infection revealed

that furacin is fully effective if given no later than 2 days after infection and at 3 days after infection, some deaths occur, but later than 3 days after infection, no protective action is discernible.

(3) Apparently the medicated mash is more satisfactory as a vehicle for chickens than the mediated drinking water, since the effective level in the drinking water can not prevent symptoms of the disease although it reduces the loss.

(4) Comparison of the weight gains of control and medicated groups indicates that 24 days continuous feeding of furacin at the lower level (feed-drug ratio, 1:12,000 and 1:15,000) does not retard the growth, but two weeks continuous feeding of the drug at the therapeutic level (1:9,000) causes a slight decrease in weight gains. After 24 days of feeding of this drug the level retardation is so slight as about 3 days, as compared to those of the control group. The medicated feed at the therapeutic level was readily accepted by the chickens.

(5) The median lethal dose of the drug is approximately 100-200 mg/kg in male chicken of 2 weeks old (body weight, 80-100 g). The therapeutic daily dose is approximately 3.5 mg in male chicken of 2 weeks old, according to the limited tests.

205. Field observations on the prophylactic use of furacin for practical control of coccidiosis in young chickens. Yoshio OKUBO, Miyoshi IKEDA, Norimoto URAKAWA, Fumio SUGIMOTO and Fujio YOSHIOKA (Journ. Jap. Vet. Med. Ass. 4, 136-141, 1951.)

Since the course of infection is very acute in natural field conditions, it is difficult to make an early diagnosis of coccidiosis and promptly initiate the treatment. Then, it is worthwhile to find a drug which may be administered continuously as a protective measure to prevent coccidial infection.

From the stand point of continuous feeding, our preliminary experiments indicate that furacin had some promise in the chemotherapy of chicken coccidiosis for the practical purposes. Further studies to elucidate the value of the drug in treatment and prevention of coccidiosis due to natural infection seemed to be warranted.

From May to September 1950, four controlled field trials were conducted on the prophylactic treatment for coccidiosis with the continuous medication of furacin. Birds used in the experiments are 1,585 in total. Poultry houses, where outbreaks of coccidiosis had occurred repeatedly every year or just before the start of trials, were employed. In beginning houses with either wooden or concreate floor construction were cleaned and disinfected according to usual procedures before being supplied with new litter. Medication was started at the time when no clinical symptom of coccidiosis were present and no sign of outbreak was observed in any group. Control groups of birds were kept in separate pens or houses, but were reared in the same condition as the treatment groups. No effort was made to hold off the affected birds in treated and control groups. Efficacy was assessed by clinical observations during the trials, daily and total mortality records, bloody droppings, final average weight and feed efficiency.

(1) Furacin administered continuously to chickens (4-6 weeks old) for a period of 30 days in a concentration of 0.011% in all-mash rations reduced the mortality from coccidiosis to 6.1%, in spite of the higher mortality of 44.1% in the untreated controls.

(2) Field examinations of the prophylactic use of 0.011% furacin in the mash given to chickens from the 13th day of age for a period of 90 days on intermittent feeding, i.e. "3 days (medication)—2 days (normal feeding)" schedule, gave good

protection against coccidiosis, since the mortality from the disease was 8%, as compared to 42.0% in the untreated controls.

(3) When given continuously for a long period at the level of 0.011% in an all-mash ration, the treated birds showed a slight decrease of feed consumptions and weight gains, but there was no noticeable effect of the drug upon the behavior and growth rate of chickens.

206. Studies on *Schistosomiasis japonica* of the domestic animals. Shin OKOSHI (New. Vet. Sci. 179-185, 1951.)

Schistosomiasis japonica is rampant in certain limited districts of Japan, China, Philippine, etc., and it causes a special endemic disease which is common to human and animals.

Infected localities of the disease in Japan are Yamanashi, Hiroshima, Okayama, Shizuoka, Saga, Fukuoka, Chiba Prefectures and others, where the disease has been noted since many years ago. As the diagnostics on *Schistosomiasis japonica* of human and animals, Spawn Smearing-, Spawn Collection-, Spawn Hatching Methods are rarely immunological diagnostics of intracutaneous- and sero-reactions have been adopted.

The diagnostics on *Schitsosomiasis japonica* of domestic animals is less valuable as to practical application, if the method does not satisfy the following conditions; the simple operation, speedy determination, exact detection and others, which are suitable to mass field test.

Cattle and dogs are infected most heavily by *Schistosomiasis japonica*, and according to the result of the Smearing Method the Spawn-finding percentage has been very low.

Hence, the distribution of spawns in the intestines of the domestic animals was studied, and it was confirmed that spawns can be found in the part of the mucous membrane of large intestine, which is as near as 1—3 mm, from the anus. So the fact was applied to the diagnostics on *Schistosomiasis japonica* of domestic animals and deviced the Membrane Scratching Method.

The operation of Membrane Scratching Method is to insert the intestine mirror into the rectum of cattle from the anus and scratch out a piece of the muccus membrane of large itnestine with long-handled, sharp-edged spoon, then dribbling glycerine to the separated piece of membrane to prevent it from getting dry, press and thin the test-piece with two pieces of plate glass and examine it, as is raw, on the spot by microscope.

In December, 1950, the Membrane Scratching Method was applied to 1,201 cows examined at 17 towns and villages where schistosomiasis was prevailing. As the result of this examination, 23.8% of infection percentage was found which was pretty good result compared with 10.5% of infection percentage by the Excrements Smearing Method that had been applied to 1,554 cows examined at 1 city and 21 towns and villages in the previous year, 1949.

As to dogs, high as 74.1% of infection percentage has been obtained.

The superior points of the Membrane Scratching Method compared with all other methods which have been taken hitherto in the medical examination of the Bovine Schistosomiasis, are generally deemed to be as follows:

(1) The results of finding the infected cows are superior to those of all other methods.

(2) The prompt judgment can be made in the medical examination.

(3) The operation is quite simple.

(4) It is enough for judgement to make up only two test-pieces from cow under examination.

(5) There is no obstacle in applying this method even when the cow's excrements become soft as the result of its feeding on juicy green grass after May, and the result of the medical examination are also accurate and show high percentage throughout the year.

(6) In case of microscopic examination, it is quite easy to find out the spawns because the tissue of the mucous membrane is transparent containing no impurity, consequently due to little exhaustion of eyesight, numbers of test-pieces can be examined in a short time and also the examination can be made continuously for many hours.

(7) As no similar spawns but oocyst of coccidium exists in the tissue of the large intestine mucous membrane, there is no trouble in discriminating spawns.

(8) The mass examination of average 100 cows in a day, can be carried out continuously for a long time, by means of examining about more than 20 cows an hour by 1 group consisted of 2 members.

In the Membrane Scratching Method, there are such good points as mentioned above, but in this method it is to have unavoidably a little haemorrhage. The tissue of the cow's intestine mucous membrane is naturally so pliant that it often has a haemorrhage even only by being inserted the arm or the intestine mirror into the anus. But as the result of trying method to 2,000 head of cows in cumulative number, no hitch has been noticed without any case of making a hole in the intestine and of causing the secondary infectious disease.

It is hoped, however, that this examining method would be carried out most cautiously so as to avoid the useless haemorrhage as far as possible.

207. Studies on cirrhosis of swine liver caused by *Stephanurus dentatus*. Shutaro Yamamoto and Kiichi Ishida (Transac. Soc. Path. Jap. **39**, 140-141, 1950.)

Recently many cases of swine liver cirrhosis, which are accompanied with serious capsulitis, have been noticed and it has been able to reveal that they are due to the larvae or immature worms of *Stephanurus dentatus*. The capsula of the liver was covered with considerable amount of newly produced villi and the proliferation of the connective tissue was markedly found in the portal part of the liver, particularly around the portal vein. In the portal vein there were many thrombus of wheat to walnuts size and which were set with the worms. The greyish white and pigeon egg sized parts of cirrhosis were scattered throughout the liver and, in the markedly increased connective tissue, the accumulated dark brown substance like soft mud was coloured as iron rust here and there. Thus the general cirrhosis was noticed as the main change in the liver in these cases.

In the interstitial connective tissue of the sclerotic parts, which markedly proliferated, occurred the formation of the pseudobile ducts, thrombosis in the branches of the hepatic artery and portal vein, the perivascular inflammation and the extention of the bile ducts. Besides, in the parts where the serious lesions appeared to be connected with the branches of the hepatic artery, the worms directly penetrated and destroyed the parenchymatous tissue to cause the proliferation of the connective tissue. The histological findings are summarized as follows:

(1) Changes in the branches of the hepatict artery: Larvae biting at the intima

and the accumulation of the eosinophile leucocytes around the worms and in the arterial walls were noticed as the most fresh changes. There were also observed either the thrombus, at the center of which the worm was found, or the bodies of the worms which penetrated into the arterial walls and caused the periarterial branches showing the various stages of the organization.

(2) Changes in the branches of the portal vein: The thrombus observed at the gross examination had the sectional surface of the worm and in many of them the organization was proceeding in a considerable degree. Arround such branches of the portal vein occurred the severe cell infiltration. As mentioned above, the liver cirrhosis described here was mainly caused by the marked increase of the interstitial connective tissue surrounding the branches of the hepatic artery and the portal vein.

(3) Lesions in the parenchymatous tissue caused by the penetration of the parasites: The abscess of the eosinophile leucocytes were encountered here and there, which seemed not to be related with vascular systems as above. One or a few liver acini were destroyed and a mass of eosinophiles was surrounded by the increased interstitial connective tissue. When the abscess seemed to be an old one, the proliferation of the surrounding connective tissue was much serious and the foreign body giant cells accumulated around the dead and not well stained body of the parasite.

208. Studies on avian type tuberculosis. I. Two spontaneous cases in cranes and experimental avian tuberculosis in rabbits. Shutaro YAMAMOTO and Kiichi ISHIDA (Transac. Soc. Path. Jap, **39**, 88-90, 1950.)

Two spontaneous tuberculosis in cranes were observed in the year of 1935 and 1950; the first case was found in Flamingo (*Phoenicopterus ruber*, kept since 1933 in Ueno Zoological Garden, Tokyo), the other in Demoiselle crane (*Anthropoides virgo*, kept since 1902 in Ueno Zoological Garden, Tokyo).

In the case of Flamingo, five necrotic lesions of soy bean size were found in the portal area of the liver. The spleen had been slightly enlarged, and almost entirely changed into necrotic tissues.

The smear from lesions of liver and spleen showed numerous acid-fast bacilli. The other organs showed no signs of the disease. In the section of the liver, accumulation of large mononuclear cells with light protoplasma staining were seen around the necrotic areas.

These cells contain so many acid-fast bacilli, that they seemed to be acid-fast masses in the cell protoplasma. Besides, there are masses of mononuclear cells surrounding the blood vessels and bile ducts, and slight infiltration of lymphocytes at the periphery of the mononuclear masses. The spleen was almost entirely beset with necrotic leisions except narrow remaining splenic tissues around the blood vessels. Around the necrotic lesions of the spleen there is also accumulation of large mononuclear cells containing numerous acid-fast bacilli. The large mononuclear cells filled with acid-fast bacilli resemble Lepraglobus in morphological characteristics.

In case of Demoiselle crane, milliary to soy bean sized lesions were found in the liver, spleen, lung, kidney, bone marrow and intestinal serous membrane. The liver was greatly enlarged and hardened due to the formation of necrotic lesions. The spleen was also highly affected, but the other organs showed only a few lesions.

At the histopathological examination, these lesions show central necrosis, surrounded by epithelioid cells and giant cells with pycnotic nuclei. The existence of giant cells was the main difference between this and the Flamingo case. The acid-fast

bacilli are mainly found in the epithelioid cells of the lung lesion, but they are by far smaller in number compared with the Flamingo case. In other organs, acid-fast bacilli are found only in a very small number in the necrotic areas.

Two strains of acid-fast bacilli were isolated from these two cases. Some experimental studies were performed on rabbits mainly with the Flamingo strain.

The intravenous inoculation of 0.5 mg. per kg. of this strain produces the so-called YERSIN type tuberculosis in rabbits, which die in 3 to 4 weeks after inoculation, showing marked swelling of spleen and liver but no visible lesions to the naked eyes. There are vigorous proliferation of large mononuclear and giant cells in the liver and spleen, and the bacilli multiply abundantly in these cells. These lesions resemble "typhom" in their morphological characteristics and the location in the liver tissue. The supravital preparation of liver and spleen shows large mononuclear and giant cells with neutral-red rosette. It is peculiar that the bacilli show a radial arrangement in the protoplasma of these cells. In this type of the disease the lung and kidney are only slightly involved, compared with liver and spleen. There are thickning of alveolar walls due to the proliferation of large mononuclear cells with few acid-fast bacilli and occasional appearence of similar cells in the renal glomeruli.

Rabbits, which survived more than 70 days after intravenous inoculation of 0.01-0.001 mg. per kg. of the same strain, show marked lesions of the lung, which resemble closely pulmonary lesions of the experimental bovine tuberculosis, and a few small discrete lesions in the kidney, spleen and liver. Pulmonary lesions of this nature did not occur in the YERSIN type. This is the so-called VILLEMIN type tuberculosis.

The involvement of the joints occurs when the animal lived very long time after inoculation, but other organs show no marked lesions in this type of the disease.

It seems that there are striking differences in the distribution of the lesions between the YERSIN type and chronic VILLMANE type of the disease. Should this phenomenon be understood, that the pulmonary lesions developed, while the hepatic and splenic lesions did not develop in the course of the VILLEMIN type, because the histopathological examination of the YERSIN type also reveals the pulmonary lesions and the existence of the bacilli in the alveolar septum and in the renal glomeruli?

209. Studies on avian type tuberculosis. II. The YERSIN type tuberculosis in rabbits. Shutaro YAMAMOTO and Kiichi ISHIDA (Transact. Soc. Pathol. Jap. **40,** 354-356, 1951.)

The intravenous injection of high virulent strain of the so-called avian tubercle bacilli produces the YERSIN type tuberculosis in rabbits, which die in about 3 to 4 weeks without showing macroscopic positive reaction following intradermal injection of 0.1 cc of the old tuberculin diluted to 1:10. The spleen shows marked swelling, and there are vigorous proliferation of large mononuclear and giant cells in the liver, spleen, bone marrow and lymph nodes. Many acid-fast bacilli are found in the protoplasma of these cells, and it is peculiar that they show a radial arrangement.

A serial investigation of the YERSIN type to know the histogenesis of these lesions and the fate of avian tubercle bacilli in several organs has been performed. 27 rabbits were inoculated intravenously with 0.1 mg. per kg. of the Flamingo strain, 5 of which have received intravenous injection of India ink for three times prior to the infection.

They were killed after various periods from 30 minutes to 21 days. The histo-

pathological examination and quantitative measurement of culture of the blood, liver, spleen, kidney, lung, adrenal, bone marrow and mesenteric lymph nodes of all rabbits by means of OGAWA's method were made. The supravital observation with neutral-red and Janus-green on the liver, spleen, lung, and bone marrow of killed rabbits was made immediately after death.

The amount of bacilli in the liver, spleen and bone marrow are larger than that of the lymph nodes, and still smaller in the lung, adrenal and kidney, and they increase with a leap at the periods of 6, 12 and 15 days after inoculation. The bacilli are demonstrable in he peripheral blood throughout the whole stages. The India ink group shows larger amount of bacilli, especially in the lung and kidney at the latter half of the disease.

The hepatic lesions have developed 8 days after inoculation into distinct typhom-like appearance, which situated in- and outside of the capillary sinusoids, and the giant cells appear in the hepatic and splenic lesions at this stage. 18 days after inoculation the lesions in the liver and spleen become as severe as those found in the dead cases. The lesions in the kidney, adrenal and lymph nodes develop at the latter half of the disease.

The India ink group shows more severe involvement of all organs, compared with non India ink group, especially of the lung and kidney. India ink particles appear in the large mononuclear cells of the hepatic and splenic lesions 18 days after inoculation, and their arrangement is closely related with that of neutral-red, both showing rosette formation. The neutral-red rosette occupies inner parts of the India ink rosette. Moreover, there is close relationship between the location of the bacilli in the cell protoplasma and that of these two kinds of rosette. The India ink rosette lies just upon the bacillary rosette, so that the acid-fast bacilli can not be seen covered with India ink particles. Only a few bacilli appear near India ink particles. Therefor it may not be due to the peculiarity of the bacilli to show the radial arrangement, but due to the condition of these cells.

The existence of bacilli in moderate number may be another factor to show a typical radial arrangement. When the number of bacilli are too small, they do not show the radial arrangement, and when the number of bacilli are too large the radial arrangement of bacilli is also indistinct, showing Lepraglobus-like appearance.

India ink particles taken in the large mononuclear cells of the hepatic and splenic lesions of rabbits, which received intravenous injection of India ink prior to the infection, must have transferred from another part of the tissue, in which India ink once have been stored, because the injection of India ink has done prior to the infection. The histopathological examination of liver, bone marrow etc. reveals the discharge of India ink particles from the capillary endothelial cells, which have kept a large amount of them immediately after the injection, and the endothelial cells becomes thin in the latter half of the disease.

210. On the leptospirosis in domestic animals. Shutaro YAMAMOTO (Bull. Off. Internat. Epiz. **36**, 321-429, 1951.)

It is necessary to run serological classification test of leptospira for the diagnosis, treatment and prevention of leptospirosis. The author had classified into eight groups testing leptospiral strains collected from various countries of the world by this method. It is to be advocated that perfect test can be done using the typical strain chosen from each one of eight groups and *L. canicola* as antigens. Author

could obtain 30 dogs (10 males and 20 females) infected with *L. icterohaemorrhagiae;* among these 1 dog was reservoir of the organism; 132 dogs (89 males and 43 females) infected with *L. canicola.* among these 21 dogs were reservoir of the organism, after the investigation of 360 dogs in Tokyo area by this method. Dogs in Shizuoka prefecture, endemic area of human autumn plague, were also investigated, and infection with *L. autumnalis* and *L. hebdomadis* been seen succeeding *L. hebdomadis* culture, being presumed most non-purulent interstitial nephritis, which observed considerably among dogs, might be caused by leptospira after examination of relationship between leptospirosis and canine non-purulent interstitial nephritis.

There are cases of bovine hemoglobinuria in Hyogo prefecture, the middle part of Japan, to be considered as an endemic disease. 6 cattle infected with *L. australis* A, 15 cattle infected with *L. autumnalis* and 3 cattle infected with *L. hebdomadis* have been recognized after testing serum drawn from 24 sick cattle. Two strains of leptospira were isolated from cattle, and study of serological properties is now progress. It is confirmed bovine leptospirosis being widely spread in western part of Japan. Mixture of leptospira strain culture got at each location killed with five tenth per cent of phenol will be effective for prevention purpose.